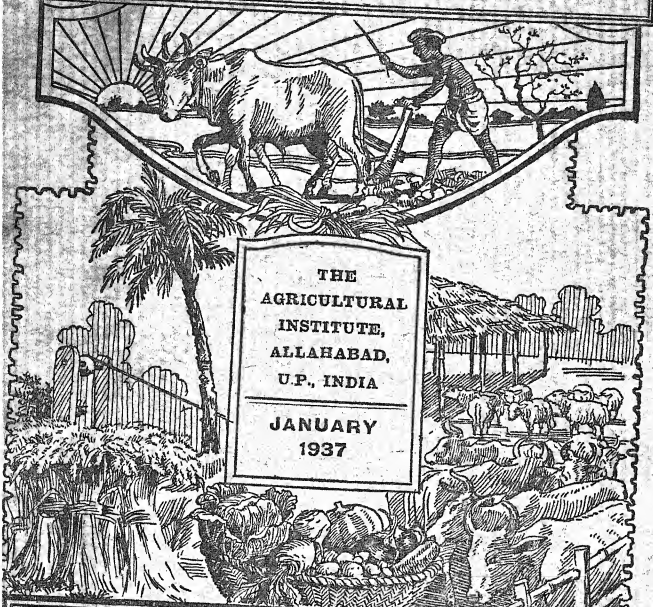
VOL. XI.] [No. 1

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



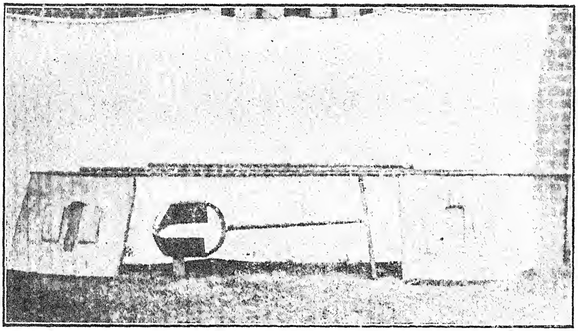
THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

JANUARY 1937

"The history of every nation is eventually written in the way in which it cares for its soil."

—*President Roosevelt, March 1, 1936.*

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

MANAGING COMMITTEE

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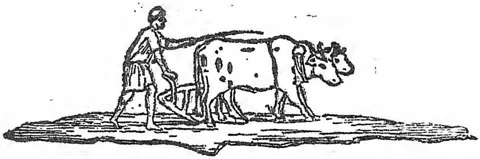
Table of Contents

THE ALLAHABAD FARMER



Vol. XI] JANUARY, 1937 [No. 1

Editorial

The classification of the citrus fruits is probably more difficult than in the case of any other group of fruits, and a great deal of confusion exists. This has resulted partly from the nature of these fruits, with their tendency to produce mutations, and probably, the occurrence of natural hybrids. Another factor has been that most of the botanists and horticulturists who have attempted classifications have been European or American, and thus unfamiliar with many of the types which are found only in south-eastern Asia. It is, therefore, with especial pleasure that The Farmer presents an article by the eminent Japanese expert, Dr. Tyozaburo Tanaka, dealing with this complicated but highly interesting problem. The first part of the article appears in this issue, and the remainder will be published shortly.

Dr. Tanaka is a professor at the Taihoku Imperial University and Director of the Tanaka Citrus Experiment Station in Formosa, Japan. As a student of the citrus fruits over a period of many years, he has won an international reputation, perhaps second to no other authority. His publications in this field are numerous and scholarly.

(Continued on page 8.)

CITRUS FRUITS OF INDIA

From the Systematic Point of View

DR. TYOZABURO TANAKA

Taihoku Imperial University, Japan

1. Introduction.

Before the extensive study of Dr. E. Bonavia, there is almost no work giving a thorough knowledge of the citrus fruits of India and Ceylon. Even by the botanists, who studied his work and interpreted the citrus fruits mentioned in the book the exact species and varieties illustrated and described are not properly understood, on account of the lack of basic knowledge of this group of plants grown in other parts of the world. To the readers of the yearly floras and economic botany of this region, it is very clear that this country produces the citron, the sour lime, the sour orange, the sweet orange, and the shaddock, in addition to many other kinds supposed to have been derived directly or indirectly from these species. Hooker, as the author of the most complete yet out-of date flora of India, added the lemon, the sweet lemon, the bergamot, and *Citrus Hystrix* to this list, and Roxburgh listed a kumquat-like citrus, called by him *Citrus inermis*, in his historical work "Flora Indica" published in 1832. Rafinesque-Schmaltz in 1838 published *Citrus Combara* (Combara), *C. Costata* (Kamala or Kolombok), *C. Gongra* (Gongra of Bengal), *C. Granulata* (granular lemon of India), *C. Karna* (Karna), and so on, in his extremely rare book "Sylva Telluriana," but these species were entirely forgotten by later investigators. The most curious thing however is that no mention is made of the commonest loose jacket of India, the Suntara (Santra), in the works published up to the middle of the ninteenth century. In early days, as is seen in the "Bombay Flora" of Dalzell and Gibson

published in 1861, the Suntara orange is thought to be of Portuguese origin, as Cintra is the name of a city in Portugal, but such haphazard notion was first driven away by Bonavia, and he gave it a very inportant place as the first class Indian Citrus. He pointed out that the Suntara orange is quite distinct from the common tight-skinned sweet orange, but it is again different from the Mandarin orange of the Mediterranean region. He also called attention to the existence of several other loose-skin oranges, especially the Keonla (Kawal), which he thinks still greatly different from the preceding kinds. Besides the lemon, lime and the citron, he also presented the true *Citrus hystrix* from Ceylon. Such an admirable treatise of Indian Citrus fruits has never been properly commented upon since no one ever critically studied these Citrus fruits from nature. A. W. Lushington, Forest botanist of Madras, wrote a critical article on the genus Citrus in "Indian Forester," June and July numbers of 1910, in which he tried to name various kinds of oranges and lemons mentioned in Bonavia's book, and he succeeded to a certain extent. There are nearly a dozen publications in recent years dealing with the Citrus fruits of India but none reached the point of giving satisfactory botanical interpretations about the proper belonging of them. It should be emphasized that the old-fashioned fuzzy grouping of distinct botanical and horticultural units into a few broad-compassed species known in European gardens, is of no value in understanding the great diversity of forms of this group of plants found in their home country. It must be remembered that the Citrus flora of this region is far more complicated than of any other part of the world, and it is absolutely necessary to segregate the unit species by precise descriptions to comprehend their true nature. It is however not the present aim to give a complete botanical account of the important kinds met with by the author during his trip in India last winter, but it is hoped that this short article may help to give a general idea of the extraordinary nature of Indian Citrus flora. It will be assumed

that the reader will first look up very thoroughly the discussion in Dr. Bonavia's book and the chapter on Citrus in the work of Sir George Watt. It is also recommended not to rely upon those incidental determinations andthe insufficient information given in various local floras and garden books. It should be remembered that the correct knowledge can only be built up from the attentive study of very large collection of fruit samples of herbarium specimens and not from the current books. It is also suggested that the local vernacular names help almost nothing in the identification of species: The standardisation of Indian names of unit species is very urgently needed to eliminate misunderstanding. Still is it more needed to complete various local Citrus floras, by collecting a large number of specimens and by preparing good descriptions and illustrations. Herbarium specimens and good analytic colour drawings of fruit samples (not like such crude drawings as those of Dr. Bonavia) are very necessary for the purpose of recording them and for the future investigations. Good photographs of such materials are also of great value for the same purpose.

2. The natural groups of Citrus fruits.

The Citrus fruits are composed of three genera, four sub-genera, eight sections and two sub-sections. India is the only country that possesses representative members of all these groups, except the trifoliate orange, some loose-skin oranges, and the kumquats. In addition to a small section of genus *Citrus* (Subgen. *Metacitrus Osmocitrus*), the trifoliate orange, *Poncirus trifoliate* Raf., and the type of the true kumquat orange, *Fortunella* (*Eufortunella*) *japonica* Swingle, are peculiar Citrus fruits of the Yangtze River region in China, but a very primitive kumquat, *Fortunella* (*Protocitrus*) *Hindsii* Swingle occurs wild on south coast of China and another member of subgenus *Eufortunella* also occurs wild in Malay Peninsula which was named *Fortunella polyandra* by the writer. Cultivated kumquats of the same sub-

genus are rarely found in India, but they are not at all common in gardens: The first is *Fortunella margarita* Swingle, the oval kumquat, and the second is *F. crassifolia* Swingle, the Meiwa kumquat. The so-called kumquat orange of Delhi and Lahore is *Citrus microcarpa* Bunge, an unique member of the section *Pseudofortunella* of the genus *Citrus* (Subgenus *Metacitrus*).

From the comparative study of a very large number of Citrus species, the author came to the conclusion that the genus is clearly divided into two subgenera, one having a distinct inflorescence, and the other without a definite common penduncle.

The principal races of the genus *Citrus* come under the subgenus *Archicitrus* comprising the following five sections with their principal Indian representatives:

Sect. 1. *Papeda*, represented by *Citrus latipes* Hook. f. and Thom, which was unfortunately confounded with *C. hystrix* in Flora of British India.

Sect. 2. *Limonellus*, represented by the acid lime, *Citrus aurantifolia* Swingle.

Sect. 3. *Citrophorum*, represented by the citron, *Citrus medica* Linn.

Sect. 4. *Cephalocitrus*, represented by the shaddock (Chakotra), *Citrus grandis* Swingle.

Sect. 5. *Aurantium*, represented by the sour orange, *Citrus Aurantium* Linn.

Most of the tight-skinned oranges and lemons belong to the above given five sections, of the first subgenus (*Archicitrus*), and all loose-skin orange types belong to the second The members of the former subgenus generally have not very flattened fruits and never get very deep colour. The acidity of the pulp is generally strong and the vesicle wall is elastic. Seeds of this subgenus contain white embryos with very few exceptions. The habit of plant in the first three sections is more low branching and the twigs are often much flexuose, whereas that of the last two sections is tall growing without such twig character. The first section § *Papeda*, comprises Citrus

species having few-flowered raceme, bearing rather small-sized white flowers with a rather small number of free filaments. Fruits are yellow, sometimes fairly good sized, globose, thick-skinned and the rind is adherent and tough. The pulp is pale yellow, with very characteristic extremely short vesicles and never sweetens. The petiole wing is extremely large, attaining to the size of the lamina. The second section § *Limonellus*, involves species having similar flowers but differs in having with a fruit very thin, leathery skin, much elongated vesicles also pale yellow pulp which never sweetens. The petiole wing is generally distinct and the texture of the leaf is usually thin. Seeds of the former are extremely elongated, flattened, upright in position, with a reticulate mark printed on the surface, while those of the latter are obovate, comma-shaped with pointed base and no other peculiarities. The third section, § *Citrophorum*, is a large group primarily distinguished by large p urple flowers, wingless petioles, and pleasantly aromatic acid fruits, oblong in shape, providing an apical mamilla In some cases, white-flowered species with acidless pulp may occur by the drop-off of dominant characters, and the petiole wing may develop in large fruiting species. The rind of fruit is still pale yellow, as in the former sections, but rarely deep orange-coloured species do occur, and tightness of the rind is also lost in very rare cases. The number of flowers and the filaments is much increased, the size of flowers, leaves, and fruits are also increased, the size of the petiole wing is decreased, and the seeds become smooth resembling the shape of those of the melon. Pulp vesicles are still very much elongated and light-coloured, not much different from the former section. Serration is often very clear on the leaf margin.

The fourth section, § *Cephalocitrus*, is greatly different from the former, but to some extent it resumes the character of the first sections, in the general approach of leaf shape, the occurrence of quadripetally, and flat, often upright reticulated seeds. The enlargement of the stature and the plant organs are very conspicuous in this section

having many-flowered very large inflorescence, extremely large flowers with pure white recurved petals, and more or less united numerous filaments, segments, and seeds. The number of filaments is however much larger in the former section and probably also the number of individual pulp vesicles. The fruits are extremely large, not elongated, the apex is always rounded and the rind is not tough as in the former sections, though it is very thick and still yellow in colour (except in some cultigens) The pulp generally sweetens in full maturity, and the large vesicles becoming shorter, sometimes arranged very irregularly, and interwoven. Anthocyanin colour often develops in the pulp but never on the flower petals. Seeds are extremely large and sharp striated. Pubsecence is frequently noted on twigs, midveins of the leaves, and on the surface of the calyx. In most cases, the petiole wing is very much developed and the lamina has strong venations and thick texture.

The fifth section, § *Aurantium*, very much resembles the former but is characterized by general decrease in the stature, size of organs, number of flowers in the inflorescence, anthers, segments and seeds. The petals are still largely recurved as in the former section, pure white, with filaments moderately united, as in the former section. The fruits are globose, generally deep coloured, thick and tight skinned, but the rind is brittle. The pulp is generally juicy and the vesicles are narrow. The increase of sugar content in the pulp vesicles is also much more advaneed than in the former section. The petiole wing of the leaves is rather well developed but not so large as in the preceding but the venation of the lamina is still strong and leaf texture is still thick. Seeds are however much reduced in size and the striation is never very strong.

3. The Loose-skin oranges

This group of Citrus fruits is very much misunderstood in western countries, as they do not produce many

races. In the Asiatic countries, it forms the most important part of the Citrus industry and the races, upon which the enterprise is based, are greatly divergent in all localities. This fact has never been properly understoed, and it is erroneosuly thought that the loose-skin orange is one kind belonging to *Citrus nobilis*, just as the tight-skin orange industry is based on one specis, *C. sinensis*.

The loose-skin oranges (*Citrus* subgenus *Metacitrus*) are classed into three sections, every member of which is characterized by more or less deep-coloured flattened fruits with loosely attached segments, thin walled not greatly elongated pulp vesicles, an open central column, and greenish cotyledons of the seeds. The first section, § *Osmocitrus*, is confined to the Yangtze River territory in its wild occurrence, but has been brought to other parts of China, and to Korea and Japan in very early days. Its leaves very much approach those of *Papeda*, having extremely large petiole wings, but the habit of flowering is greatly different. The flowers of this group are solitary or fascicled, never forming an inflorescence very large in

(Continued on page 52)

EDITORIAL

(Continued from page 1)

For many years Dr. Tanaka has been interested in the citrus fruits of India, and last winter spent about three months in this country, studying them at first hand from Madras to the foothills of the Himalayas. The present article is an outcome of that study, and therefore of great importance. Dr. Tanaka goes to the opposite extreme from those authors who would divide all the citrus fruits into three or four species, and not all will be willing to go with him all the way. But all future classifications must take into consideration his most valuable contribution.

HISTORY OF HORTICULTURE IN INDIA

W. B. HAYES, M. Sc.

Horticulturalist, Agricultural Institute

"Such mangoes as are good are excellent. Many are eaten, but few are good of their kind. They pluck most of them unripe, and ripen them in the house. While unripe, the mango makes excellent tarts and extremely good marmalade. In short, this is the best fruit of Hindustan. The tree bears a great weight of fruit. Many praise the mango so highly as to give it preference to every kind of fruit, the muskmelon excepted; but it does not appear to me to justify their praises."

Thus wrote Baber in his Memoirs, and one interested in the history and literature of horticulture cannot but wish that other early writers had written as fully, accurately and zestfully. Even Baber, however, seems to have had the common failing of remembering the melons and other fruits of his childhood as being more luscious than any others. Baber has more to say about the mango, and mentions some twenty-seven other fruits which he found growing in India. This is no dry list, but contains such statements as the following: 'The plantain has two good qualities: the one is, that it is easily peeled—the other that it has no stones, and is not stringy.' On the *jaman* 'Its fruit resembles the black grape, but has a more acid taste, and is not very good.' He mentions that the jackfruit is borne on the branches, trunk and root, but likes neither the flavour nor the appearance, which he says is 'like a sheep's stomach made into a haggis.' The date is reported to resemble the animal kingdom in two respects. It dies when its head is cut off, and bears no fruit without the presence of the male tree. The tapping of the date palm for juice is described.

The other fruits mentioned by Baber are the tamarind, mohwa, *kirni*, 'kermeric' (carambola), 'badhil', jujube,

karonda, paniala, *guler*, 'amleh' (*aonla* ?), *chironji*, coconut, *tar*, *naranj* or Sevile orange, other types of orange, lime, *taranj* or citron, *sengtereh* or common orange, *kilkil* or large lime (*galgal* ?), *jambiri*, *sadaphal*, *amratphal*, *kirneh*, and *amilbid*. 'They say that if a needle be thrust into the heart of it, it melts away'.

It is not the purpose of this paper to present a complete statement regarding the history of horticulture in India, nor is the writer capable of such an enterprise. Rather is the object to share with the readers some of the more interesting findings of a brief study of the subject, limited to books written in English or translated into that language. It is hoped that the readers will correct any mistakes, and add further information, either in articles in this journal, or in communications to the author. The aid of those familiar with the Hindu classics is particularly desired.

Very little mention of fruit has been found in such English translations of the Hindu classics as have been consulted. The *Matsya Puranam*, translated by 'A Taluqdar of Oudh', mentions the following fruits: Citron, breadfruit, mango-hog-plum, wood-apple, coconut, fig, jujube, lemon, plantain, pomegranate, *Emblica officinalis* (?), rose-apple, *Eugenia jambolana*, bael, tamarind, karanda and grape. If this is a correct translation, it affords evidence that these fruits have been grown in India for a very long period, which is certainly true of most, if not all of them. However, it should be recognized that the translation of such names is frequently very difficult, as the same name may be applied to more than one fruit at different times in the history of a language, and in dead languages it is sometimes impossible to know positively what fruit is meant by a certain name. One wonders at the inclusion of the breadfruit, which is grown only in the southern part of India, and not commonly there, and the exclusion of the much more important jackfruit, of the same genus. The 'Taluqdar' seems at times to consider the wood-apple the same as the bael,

and one does not know which should be included, or whether both are meant.

Among the earliest foreigners to visit India and leave written records of their travels are Chinese Buddhist pilgrims. One of these, Yuan Chwang, was in this country from 629 to 645 A. D. According to a translation made by Thomas Walters and published in 1904, the chief fruits were the mango, tamarind, mohwa, jujube, wood-apple, myrobalan (probably *phytlanthus imblica* the *aonla*), a species of Diospyrus, *Ficus glomerata*, plantain, coconut, and jackfruit. There is also a reference to the peach and pear as having been introduced into India from China. Pomegranates and sweet oranges are also mentioned.

A number of the temperate fruits seem to have been growing in the region to the north-west of India for many centuries. Yuan Chwang states that 'from Kashmir on' (apparently on toward China), pears, plums, peaches, apricots and grapes were planted here and there. Light is shed on his own horticultural background when he mentions that the Chinese jujube, the chestnut, and the green and red persimmons were not known in India. Baber speaks of the grapes, melons, apples and pomegranates of Samarkand, and lists the following as growing in the cold region around Kabul: grapes, pomegranates, peaches, pears, apples, quinces, jujubes, damsons, almonds and walnuts, while in the warmer section he found the orange, 'citron' (with a berry like the karonda) and a fruit called amluk. Mention is made of the Bagh-i-Vafa (Garden of Fidelity) in Afghanistan, where he found the pomegranates excellent but 'not equal to the fine ones of our country.'

Baber was not the only Moghal writer who mentions fruit. The author of the Ayeen Akbery lists a number of fruits, including the pineapple and custard apple which are not found in the earlier lists. Both of these fruits are believed to have come originally from tropical America, although many have regarded the custard apple as indigenous to India.

Early European visitors to India found much that was strange and interesting, and wrote about it freely, frequently mentioning the fruits and other products which they saw. One of the first was one Willam Bruton, who sailed from England in 1632, and afterward wrote *News from the East Indies*, or *A Voyage to Bengalla* He states, 'Good fruits they have in abundance, as cocoa-nuts, mangoes, pine-apples, guavas, limes, lemons and oranges'. The mulberry was grown, but largely for silk production. Pietro Della Valle, who was in India even earlier (1622-23), found the following fruits which he said had been brought from Brazil: Papaia (papaya), Casa or Cagiu (cashew), Giambo (*jaman*), Manga or Amba (mango), and Ananas (pineapple).

'Asia, the first part being An Accurate Description of Persia and the Several Provinces thereof, The Vast Empire of the Great Mogol, and other Parts of India,' is part of the title of a book published by John Ogilby in 1673. If the statement that a pint of Ganges water weighs only half as much as of any other water is a fair example of the alleged accuracy, not too much confidence can be placed in the list of fruits which is given. However, the list is of some interest for its spelling as well as its contents. The chief fruit is said to be the coconut, and the others are: bananas, anana's, jaca, mangas, jambes, jambolins, fangomas, carambolas, brindoins, durions, papaio's, injames, tamarind, caranda's and mangostans. It is not clear what fruits are meant by a number of these terms.

Medical men have contributed much to literature, and one who surely deserves to be quoted at some length is John Fryer, M. D., who travelled in Persia and India from 1672 to 1681. Near Madras he found plantains, the guava, jackfruit, mango, 'plum', pomegranate, and 'bouanoes' which he said were smaller but better than plantains; and in 'Canatick', the 'thamarind'. His medical interests are apparent from the following quotations: '...the *Mango* (which they have improved in all its kinds to the utmost Perfection) being a Sovereign Medicine; they are the best

and largest in India......the Fruit when green scents like Turpentine, and pickled are the best *Achars* to provoke an Appetite: when Ripe, the Apples of Hisperides are but fables to them: for Taste, the Nectarine, Peach and Apricot fall short; they make them break out, and cleanse the Blood, and Salivate to the height of Mercurial Arcanaes: and afterwards fatten as much as Antimony, or Acorns do Hogs.' 'A Pine-Apple...the Taste inclinable to Tartness, though most excellently qualified by a dulcid Sapor that imposes on the Imagination and Gustative Faculty a Fancy that it relishes of any Fruit a man likes, and some will swear it...'

Another doctor, Francis Buchanan, M. D., published in 1807 *A Journey from Madras through the Countries of Mysore, Canara, and Malabar*, in which he states that in the gardens of Tippoo the apples are much better and the peaches much worse than in Calcutta. In Seringapatam he found the coconut, plantain, lime, sweet orange, bitter orange, guava, pomegranate, jackfruit, mango, *Phyllanthus emblica*, tamarind and *Spondis dulcis*. From the other side of the Peninsula, we find the following fruits of Bombay gardens listed by James Forbes in his Oriental Memoirs, published in 1813: Guava, plantain, banana, custard apple, jaca, tamarind, cashew-apple, ananas, jamboo, orange, lime, citron, grape, pomegranate, mango, pompelmose or shadock (pummelo), carambola, bilimbing and corinda. Bengal is also represented, by M. Martin, who published, in 1838, *The History, Antiquities, Topography, and Statistics of Eastern India*. In it he lists the following as fruits of Dinajpoor district: Mango, jack, Psidium, pineapple, papaya, Engenia jambos, Batabi (*C. decumana*), mulberry, pomegranate, peach, and in the gardens of Europeans, also the loquat, litchi, wampi and avocado.

While Ceylon is not politically part of India, it is so closely related as to make the history of its fruits of interest. The prospect for fruit growing there must have appeared very good to J. W. Bennett who published *Ceylon and its Capabilities*, in 1843, for he lists 35 in-

digenous fruits as well as 21 naturalized exotic fruits. The former list cannot be regarded as at all accurate, but indicates which fruits were by that time well established in Ceylon. His 'indigenous' fruits are the pineapple, orange, shaddock, lime, citron, guava, papaya, mango, custard apple, bullock's heart, bilimbing, carambole, *Annona acida*, jack, breadfruit, *Terminalia catapya* (which he calls St. Helena almond), *Citrus tuberoides*, *Eugenia malaccencis*, *Triphosia aurantiola*, plantain (*Mus. sapientum*), banana (*M. paradisica*), cachew apple (cashew), *Zizyphus spinosus*, jar plum (*Calyptranthes jambolana*) wood apple, khon (*Dimocarpus sp*), tamarind, *Ficus sycamorus*, rattan (*Calamus rotang*), Ceylon olive (*Ele- acarpus serratus*), melon, slime apple (*Embryoptoris* glutinifera) myrobolams (Myrobalamus zeylanires), and watermelon. The naturalized exotic fruits are the mangosteen, rambutan, nam-nam (Cynometra cauliflora), rose-apple, soursop, Brazil cherry, strawberry, mulberry, vinifera grape, loquat, star apple, Canary almond (Canarium communis), lemon, bladder cherry (Physalis alkahengi), fig, lovi-lovi, stripe-leaved pineapple, wampi, pomegranate and melon.

Before these later books were published, Europeans living in India had begun to establish gardens and were interesting themselves in the fruits as well as the flowers of the country, and also such as they could import. In 1820 that most versatile missionary, William Cary, had founded the Agricultural and Horticultural Society of India. The first volume of its transaetions was published in 1837, and contains a note written by Robert Tytler, M. D., of Allahabad, describing the agriculture of the district, and stating that he had the following fruits growing in his garden: Lemons, limes, the orange, citron, pomegranate, pumplemuss, figs, lichies, guavas, peaches, apples, vines, custard apples, papayas, plantains, jammuns, jujubes, and mangoes. The chief orchards of the district were said to be of mango and jammun, while bela fruit and mulberries were also grown. The famous guava orchards of this district seem to have been planted later.

Between 1837 and 1841, eight volumes of the Transactions of the Society were published. Proceedings were published monthly from January, 18 1, to June, 1842: and the Journal from August 1842 until 1920, when lack of support forced its discontinuance. Since then only annual reports are published, although the Society oontinues t) exist, and to maintain its beautiful garden in Calcutta. In the early days branch societies were established, and there is reference to that at Allahabad, which on August 15, 1841, had 60 members, of whom it happened that 'one-half are Christians and the others natives.' One wonders what inducements would have to be offered to secure 60 members for such a Soicety today. A note in the Proceedings for May, 1842, records the first successful shipment of English fruit trees to Upper India. They went to Saharanpur.

The early interest in gardening, under conditions so different from those in Europe, encouraged the production of gardening manuals, some of which have gone through a number of editions and are still popular. Most of these are intended for the guidance of the amateur gardener, and devote the most of their pages to flower growing and landscaping, with a shorter section on vegetables, and a still shorter one on fruits. Even today there is no book of any standing on Indian horticulture from the commercial point of view.

One of the earliest of these manuals was "The Indian Handbook of Gardening," by Speeds, published first in 1842, and revised a few years later as "The New Indian Gardener." It is typical in that it deals with vegetables, fruits and flowers. and it is interesting to note that nearly 60 species of fruit are discussed. These are: Peach, apricot (rare), almond, *Terminalia catappa*, plum, 'native plum' (jujube , cherry, 'Java plum' (*Eugenia jambolana*), olive (*Olea dioica*, said to be indigenous to Eastern Bengal , 'native olive' (*Elaeocarpus suratus*), mango, hog-plum, apple, pear, quince, loquat, Malay apple (*Eugenia alba*), 'leechee', longan, wampee, mangosteen (very rare), custard apple, bullock's

heart, sour sop, avocado, jack, guava, pomegranate, carambola, pierardia (*lutkoo* or *lutka*, *Pierardia sapida*), jasmine flowered carissa(karonda), paneola plum (*Engenia paniola*), India star apple (*Chrysophyllum acuminatum* said to be indigenous in Sylhet), papaw, orange (chiefly in the eastern parts of India), citron, lemon, lime, fig, plaintain, pineapple, grape, grewia (phalsa), mulberry, raspberry, strawberry, 'winter cherry' (Cape gooseberry), 'the nut' *Corylus avellana* the filbert, walnut, musk melon, water-melon, coconut, 'Borassus (*taree*), elephant or wood apple, Bengal quince (bael) tamarind, Indian sorrel.

"The Forests and Gardens of South India" by Cleghorn, published in 1861, deals only incidentally with fruit trees. But three years later there was published a book which has probably been the most popular book on Indian gardening for nearly 75 years, as Firminger's Manual. It was first issued as a Manual of Gardening for Bengal and Upper India, by the Rev. Thomas A. C. Firminger, M.A., Chaplain on the Bengal Establishment. "India Gardening" by Pogson was published in 1872, and deals with much the same list of fruits as Speeke's book, but in somewhat more detail." "Hints on Gardening in India" by G. M. Woodrow, of the Ganeshkhind Gardens, Poona, was first published in 1876, a rather small and general book which has gone through several editions and later appeared under the title "Gardening in the Tropics." The first edition of "A Manual of Gardening for Western and Southern India," by Riddell must have been published by this time, as the 5th edition came out in 1884. After a short general section it deals with ornamentals, vegetables and fruits, the species being arranged in alphabetical order. The same treatment is used by Warde in a small book published by the Army Press in Simla, without any date.

In some ways the most significant book on a horticultural subject written in India is "The Cultivated Oranges and Lemons etc. of India and Ceylon," with researches into their origin and the derivation of their names, and other useful information, by E. Bonavia, M.D., Brigade

Surgeon, Indian Medical Service. It was accompanied by a volume of carefully drawn illustrations, and published in 1890. This is a scholarly work of 365 pages, and while many of the conclusions cannot be accepted today, it is still of real value, and was a most remarkable contribution to the knowledge of an imortant group of fruits, the classification of which is still very difficult. Bonavia, showed clearly how untenable was the position taken by previous botanists, yet his work seems to have had little direct effect. This fact struck Lushington, who in 1910 published a long article on the genus citrus in THE INDIAN FORESTER, in which he attempts to work out a systemtic classification based on some of Bonavia's theories.

Woodrow, whose more general books have been mentioned, published a small work on the mango in 1903 which was perhaps the most complete treatise on the subject until the "Book of the Mango" by Burns aud Prayag appeared in 1920.

Mention should also be made of two later books on gardening each with only one brief chapter on fruits, revised editions of which are now being prepared. One of these, "The Indian Amateur Gardener," by 'Landolicus' had reached its third edition by 1902. The other, "The Amateur in an Indian Garden," by S. Percy-Lancaster was published in about 1929.

We have a very interesting booklet of 53 pages entitled "The Young Builder" which is printed by the Edinburgh Press, 300 Bow Bazaar Street, Calcutta, and published by the author, Mr. R. M. Robertson, architect, at Moni Villa, Darjeeling. This booklet is for the instruction of apprentices and beginners in building construction. It explains the problems of building simply and in easy language, and includes simple discussions of the elements of architectural design. For those who are especially interested in building construction it is a very useful booklet. The price is Rs. 3.

FURLOUGH OBSERVATIONS

MASON VAUGH

Agricultural Engineer, Agricultural Institute

As we have travelled round, nearly half way round the world geographically and considerably more than half way round in miles, I have tried to observe things of interest agriculturally. Some of them may be of interest to readers of THE FARMER.

After leaving India, the first agriculture we observed was along the Suez Canal where for a considerable distance from the southern end, there is cultivation along the canal. There was no opportunity to go ashore but the impression was that it was very similar to Indian cultivation, cattle being used to draw a plough which from a distance appeared much like an Indian plough. The cattle observed through a glass appeared to be better than the ordinary Indian cattle, having large udders. The fields often contained lucerne and what appeared to be Burseem.

Though we spent several days in England, I got very little chance to observe at close range. One day was spent at the Institute for Research in Agricultural Engineering where I was cordially received. I was taken to several farms which were fairly completely mechanised, for brief visits. Much of the land is in grass. Arable farming seems to be done very thoroughly. I was struck by the prevalence of cast chilled ploughs, the steel plough bottom seeming to be practically unknown. I spent a half day visiting Reading College. I got the impression that dairying was given the chief place in their work with much emphasis on cheese making. The Agricultural Engineering department was poor and I was not shown much else.

I spent several days visiting engineering firms where I was given every possible help and attention and was

shown round plants and taken to points of interest, especially places where I could learn things to help in making better ploughs.

Since arriving in the United States, we have travelled some 7,000 miles by car from New York down to Atlantic City and back, across country through Itheca, Geneva, Niagara Falls, Buffalo and Chautauqua, New York, down across the states of Ohio, Indiana and Illinois to central Missouri. After visiting our relatives, we returned by practically the same route to north-central Ohio, where we are to spend the winter. After establishing ourselves in our home here, we again started out and drove down through Ohio, Kentucky, Tennessee, Alabama, Mississippi, and into Louisiana. We returned through the same States but most of the way by different roads.

As we went westward on the first trip, the winter crops of wheat and barley and spring oats, as well as hay, were being harvested. Threshing was also in progress. The striking feature of the harvest was the extent to which combined harvester-threshers are displacing other methods of harvesting. I stopped and talked to users and found them enthusiastic about them. Twine makers and dealers have been much agitated here over the amount of foreign made binder-twine which has been coming in from countries where the fibre is produced and twine made directly. My impression is that their agitation is misguided. If I read the signs aright, the market for binder-twine, foreign or domestic made, will rapidly dwindle to practically nothing in a few years as the whole crop will be harvested without being bound into bundles at all. The wheat crop was very good throughout the area we covered, offsetting to a considerable extent the disastrous drought which ruined the summer crops.

The overwhelming feature of mid-western agriculture this season was the terrible heat and drouth. Ohio has a fair corn crop, Indiana and Illinois have some, west of the Mississippi River there is little. The tem-

peratures were high, up to 113° F. or more, and persisted for very long times. Not only were crops badly damaged and people suffering but even trees were killed in many places. There were no such dust storms as had happened previously. By the time we reached Missouri, the harvest was finished there and the drought had brought other activities largely to a standstill. I did see some terracing being done and many people were digging ponds and drilling wells for water supply.

As we went southward, we saw a great contrast in the appearance of the countryside. In the north, the farms look well kept, the crops are clean and the fences are kept in repair. As we went southward, especially in Alabama, Mississippi and Louisiana we could see that the houses, of wood, were rarely painted, fields were not always fenced, and the whole aspect of the countryside was one of neglect and careless cultivation. The difference may be explained in several ways. In the north, many if not most of the farmers own their land. They have up-to-date tools and implements, many use tractors. In the south, the farming is done mostly on small plots by tenant farmers, many of whom are negroes, illiterate and poor, and most of the work is done with small implements using often only one mule or horse. The results show strikingly in the work accomplished.

We visited several places of int rest. Berea College in Eastern Tennessee draws its students largely from the poorer mountain families. They are doing a great deal to foster cottage industries. A large number of the students earn much of their expenses and the college maintains various things for them to work at ranging from hand looms, through a gasoline filling station to a big hotel. We spent some time there and were impressed with the idea that most of the cottage industry catered to a luxury trade and that the prices asked would shut the products entirely out of any market where the prime requirement was serviceability. Most of the work, aside from the bakery, laundry, etc., serving the community, was run on a purely commercial basis

to provide work and not for training purposes at all. They do not expect the students to follow the industries at which they work after leaving the college. Tuskeegee, on the other hand, has extensive shops for the training of workmen. School was just starting as we arrived there so perhaps we did not see it at its best; our impression was of half-filled shops. We were told repeatedly that the students were much more demanding professional courses and literary education and less and less, technical training. We were very favourably impressed by the general appearance of the Institute and the earnest, intelligent expression of the students as they went about their duties.

We visited the new Norris dam near Knoxville and the famous Wilson dam at Muscle Shoals. At the latter, we saw the fertiliser factory where superphosphate is being made by extracting phosphoric acid from the rock and using it to treat other rock to form the super. The original extraction is by smelting in electric furnaces, recovering metallic phosphorous. This is either condensed and stored for future use or burned at once and converted into the acid. The acid is then mixed with the phosphorous bearing stone, stored for some weeks to allow the reaction to be fully completed and the material to dry before being crushed and bagged to go to farmers.

This fertiliser is being used in the Tennessee Valley Authority scheme of agricultural improvement. It is furnished free of cost to farmers who will contract to cooperate in their programme which involves terracing the fields to prevent erosion, the use of lespedeza and other soil building crops, and a general scheme of improved agriculture. The cost is recovered, I believe, from profits on the sale of electric current generated at the dams in the valley.

Terracing is very widely practised all over this area and is being done increasingly. Strip cropping, contour ploughing and planting and other methods are being experimented with. Alabama farmers are getting

excited over sann as a green manuring crop. As an example, I was told of one farmer who sowed some 30 pounds of seed some years ago on land previously producing about 4 maunds of maize seed per acre. After ploughing under the crop, his yield jumped to some [illegible]0 maunds and has remained there since. The practice is to allow it to seed before ploughing under. When a cultivated crop like maize follows, that between the rows is ploughed out like any other weed. Whatever is in the rows matures and makes seed enough for the following year.

In Tennessee, great interest is being taken in lespedeza. At Knoxville, they are experimenting on the possibility of growing crops; even cereals in a comparatively permanent lespedeza sod. They are trying to develop a plough which will open only a narrow furrow, without disturbing the whole sod, with the idea of planting the seeds in these furrows. They seem convinced of the value of the method, the only question now being of equipment which will do the work

At Knoxville, I also saw a small hammermill grinder which seemed to me to have considerable promise. The new thing about it was a vibrating feeder which seems to feed the grain to the grinder with remarkable uniformity. They are also working on a small fanning mill, a small thresher and various other things, all designed to help the small cultivator.

I spent a very interesting afternoon at Aburn, Alabama. Unfortunately the head of the Agricultural Engineering Department was busy. He is an old class mate of Dr. Higginbottom, Prof. M. L. Nichols. He has been spoken of to me as the one who combined the widest knowledge of soils and agricultural engineering in the United States. He has done a lot of research to try to develop a method of designing plough bottoms by mathematical formula and the department is now working on soils physics. I had the good fortune to spend the afternoon with Dr. Yoder who is doing this work. They are developing a method similar to mechanical analysis of soils

with which they have been able to determine very accurately the erodability of soils and to learn why some soils erode while others on the same slope and under similar working do not. They think it is a function of the degree to which the soil slakes under water into consituent particles, those breaking down most completely eroding worst.

The College there, in co-operation with the U.S. Department of Agriculture, have set up one of the most unique laboratories for the study of the relations between soils and implements I have heard of anywhere in the world. They have a series of plots enclosed in concrete walls within which they have filled different soils so as to have a wide variety of soil texture and structure available in the one spot. The plots can be covered to shut off rain water or sprinkle irrigated so that moisture conditions are under control at all times. Rails are laid on top of the concrete walls and an elaborate dynomometer car has been built so that it is possible to measure every component of force acting on any implement under test in any type of soil chosen. The laboratory is just nearing completion. It appears likely to materially enlarge our knowledge of the inter-relation between soil and implement. They also have an elaborate system for measuring runoff and soil loss from plots under different conditions.

Enroute from Missouri here, we visited the Illinois State Fair and on our way south, we visited the Ohio State Fair. Both had to be done hurriedly but we did get to see something of the cattle, horses, implements and other displays. In both cases they have a "Junior Fair" especially for the young folks, boys and girls, in which they exhibit their work. I found this intensely interesting.

We were fortunate in having no accident or major trouble on the road till within about 15 minutes of home on the end of the trip south. We were then sideswiped by a drunk driver and considerably damaged. The damage to the car has been largely repaired and the injuries are healing rapidly so we think we were very fortunate in that also.

RESEARCH AT THE INSTITUTE

During the present year there are three new projects of research being carried on at the Agricultural Institute. Two of these are connected with the Animal Husbandry and Dairying Department and one with the Agronomy Department. The short notes given here state the problems which are being studied and the purposes of the particular research which is being done. Each is written by a staff member who is engaged in that particular research.

I. COMPOSITION OF MILK

By I. D. Dharni, M.Sc.

Careful studies of the compositlon of milk in India have long been needed. Most of the problems of milk production stand to gain by an accurate determination of milk composition: cattle breeding, animal feeding, dairy manufacturing and veterinary service, each can use the results so obtained. Not only these but the problem of home nutrition could be more intelligently coped with if accurate descriptions of milk composition were available.

After consultation and discussion a research project on this problem was planned and approved to be carried on by the Agricultural Institute in co-operation with the Imperial Council of Agriculral Research. The problem selected was the composition of milk of Indian cattle and is to include Scindhi cows, Holstein—Scindhi cows, buffaloes, and village cows.

There have been very few analyses of milk reported in India, and most of these have been incomplete. In most cases the fat percentage was determined. In addition some workers have determined the specific gravity, the percentage of solids not fats, and the percentage of total solids. Unfortunately the data from different experiments cannot be easily compared because in the published results there has been no mention as to how ex-

periments were carried on: whether the samples were from individual cows or from herds or whether the samples were composite ones or were from one milking.

In this experiment the animals are selected according to their environment (whether village or Institute cattle), different lactations, state of nutrition and age. Cows of ages of three years or more are being used. Regular records are being made of the kind of feed given and of changes in the weather and the season.

In this experiment it is intended to determine the the physical properties: specific gravity at 60° Fahrenheit, and the freezing point, and the chemical properties of (1) percentage of fat (2) percentage of protein (3) percentage of lactose (4) percentage of total solids (5) percentage of solids not fat (6) percentage of ash (7) percentage of calcium (8) percentage of phosphorus. The study will also include the kind of protein and organic sulphur found in milk if time and funds allow. We have no report of a worker so far who has investigated the organic sulphur in milk. The effect of changes in weather, nutrition, season and age, on lactation yield and on the constituents of milk will be closely observed for each of the different breeds.

Included in the final report of the experiment will be a digest of the results of former experiments on this general problem.

2. FEEDING VALUE OF MOLASSES

By A. Rathore, B. Sc. (Ag.)

Since 1932, when the sugar industry was given protection, there has been a tremendous increase in the production of sugar. This has led to the production of large quantities of molasses as a bye-product and the consequent problem of disposing of it. Various methods have been and are being tried. These range from using molasses as road building material, to its refinement to make it suitable for human consumption. It may be

pointed out that molasses has about 60 per cent. carbohydrates of which about 25 per cent. are invert sugar. Thus it possesses a high food value and its use as feeding stuff seems to be natural enough.

A number of trials have been conducted in America, Hawaii and elsewhere using molasses for cattle feed and as an appetiser. In India, S. Labhsingh an S. Gambirsingh have done some work at Lyallpur and they report very favourable results except during hot weather.

Recently, the U.P. Government initiated a scheme for finding the feeding value of molasses. The work was entrusted to the Harcourt Butler Technological Institute which in turn decided to have the trials run at several places. The Allahabad Agricultural Institute was chosen as one of the places and the Technological Institute promised free delivery of twelve hundred maunds of mixed molasses feed at Naini station.

The object of the experiment is to see the influence of feeding molasses on (1) work stock ; (2) milch stock ; and (3) young stock. The issues under investigation are:—(1) palatablity of the feed, (2) effect of the feed on (*a*) health (*b*) body weight and (*c*) production of milk or draft, and (3) the value of the feed in terms of some well-known feed. At present the trials are confined to work stock but it is hoped to extend them to the other stock also.

Recently, the "paired feeding method" has come into vogue in feeding trials. This method lends itself very well to the present work and is being applied in this trial.

Eight pairs of bullocks have been selected from the Agronomy department work stock. The animals in each pair are more are less similar in breed, age, health, body weight and general constitution. The animals have been examined by the Institute veterinarian and thoughout the experiment, a watch will be kept for any unusual symptoms. The pair-mates always work in the same pair thus doing equal work. They receive similar treatment in all respects except in feeding. They are muzzled so that they do not have any opportunity to eat anything not prescribed in the experiment.

All feed intake is equalised between pair-mates, on the basis of their body weights. All of them receive Juar silage as roughage. One pair-mate receives a concentrate ration consisting of wheat, bran and mustard cake (4:1). The other pair-mate is fed on equalised amounts of the molasses feed sample F, which is composed of molasses, groundnut cake and bagasse screenings (4:3:2).

Composition of the feeding stuffs.

	D. M.	Dig. Cr. Protein	Dig. Fat.	Dig. Fibre	Dig. N.F.E.	T. D. N.
Molasses feed sample F	93·08	9·84	1·65	3·01	40·54	57·1
Wheat bran ..	90·38	12·23	3 68	1·86	39·1	61·9
Mustard cake (4:1).						

All animals are fed separately and individually. Persistant refusal to eat any one feed will be taken as an indication of disageeable palate. All animals received 1% salt in their concentrate ration.

Throughout the experiment, the animals are to be weighed three consecutive days every week. The average of these being taken to be the weight for the second day of the weighing.

The experiment is to continue for eight weeks or more. At the end of this period a two week preliminary period will be given, during which time attempt will be made to bring all animals back to the starting level of body weight. After this, the feeds will be reversed i.e., the animals receiving molasses feed during the previous period will receive the mixture of wheat, bran and mustard cake and *vice versa*. This will enable each animal to act as its own control and eliminate the differences due to individuality. The trial will continue for another period of eight weeks or more.

The gain or loss in body weight is taken as a measure of the feeding value of the feed. The data thus

secured will be statistically analysed by the "student's method".

On the basis of results obtained, suitable adjustments in the amounts of feeds will be made and work carried on these lines till the feeding value of the molasses feed has been found out in terms of the equivalent amounts of the control ration as indicated by equal gains in weights or maintenence of body weights at the same level.

3. PLANT IMPROVEMENT RESEARCH

By Dr. E. F. Vestal, Ph.D

The Botany Section, the Agronomy Department, and the Institute Farm are carrying on the plant improvement programme which, as in the past, consists of selection of better varieties and the improvement of those already selected by further selection within the variety. The lines of selection are in two directions; (1) crop yield improvement and (2) disease resistance. The problem of disease resistance is extremely acute this year with the red spot of juar destroying from 75 to 95 per cent. of the leaves and the mosaic disease destroying a large percentage of the tomatoes and reducing the yield of the chilli crop.

In a randomized layout on the Institute Experiment Plot eight of the best varieties of Indian wheats are being tested for yield and disease resistance under local conditions. In addition to the randomized plot fifteen foot rows have been planted of varieties of farm crops. Among the varieties planted are 22 varieties of oats (ten of which are from the U. S. D. A.), 16 varieties of wheat (6 of which are from the U. S. D. A.), 14 varieties of barley, 3 varieties of flax, 2 varieties of lespedeze (the Japanese clover) and a number of other crops. These last plantings are serving a double purpose. They are to test the various varieties in this climate and soil and also to serve as a laboratory experiment for the Agronomy majors.

OLD BOYS' DAY

December 3rd was designated as Old Boys' Day at the Institute. Classes were dismissed for the day and a full day programme was arranged. The morning programme included a hockey match, a volley ball game and a meeting. In the afternoon there was a business meeting of the old boys followed at 4 o'clock by a tea party given by the present students of the Institute. Growing out of the business meeting a committee was formed with Mr. G. Q. Vachoo as convener to investigate the desires of the old boys as to whether or not they would like to have an Old Boys' Association. Further details about this committee and its work are also included in this issue of THE FARMER.

For the day's activities about ten of last year's students had returned to the Institute. It was a convenient season for them inasmuch as they were to receive their degrees at the University convocation on December 5th. Among those who could not attend there were several who wrote to Mr. Koshy, the President of the Students' Union, in reply to the invitations which had been sent to them.

Mr. V. T. George who finished his Intermediate course last year wrote from the Alwaye Settlement where he is teacher of agriculture that the chief reasons for his absence from the Old Boys' celebrations were the distance of 1,800 miles which lies between him in South India and the Institute and the fact that he is very busy in his work which the Institute prepared him to do.

Mr. R. S. Rathore wrote from Udaipur that he would have attended the celebrations had not the Head Master of his school been absent on business. He extends, to the staff especially, a cordial invitation to visit him at his work which he assures everyone is amid very favourable surroundings.

Along with these letters came other letters of greeting from P. Mukerji, Chemical Section, Imperial

Agricultural Institute, New Delhi; A. Mukerji, Rasulabad Nursery, Allahabad; Krishna Pal Singh, "Castle Grant," Agra; B. Haque, Khalsa College, Amritsar; S. Chatterjee, B. Sc (Ag), Agricultural Officer, R. D. G. Farm, Dihapatiya Junior Raj, P. O. Dayarampur, Rajshahi; P. N. Sud, Kailash Dairy Co., Ludhiana.

One of these letters we wish to reproduce here in full. It came from A. K. Mitra, a student in the B. Sc. class of 1935. We print it here because it is typical of many reports from students and at the same time it shows a concern for the welfare of the present students and words of counsel to them which we feel are worth repeating.

MY DEAR KOSHY,

Many thanks to you for inviting me to the gathering of the old boys. I so much wish to join in the meeting, to renew my friendship with all and to tender my love to the professors to whom I am indebted for their teaching. But circumstances do not permit me to run down and meet my friends. I have taken a contract to supply five lakhs maunds of cane to a sugar mill and the mill is going to start from the first of December so it is not possible for me to go to Allahabad on the second. Anyway I am trying to make arrangements for it and if business permits I shall be with you on the third.

Perhaps my friends would like to know what I am doing since I left the Institute. Well, may I say that I have taken to the profession for which I am trained—that is, I am a farmer. Now you may want to know how I am doing in farming? Will you permit me to say that my humble self has been able to develop the farm much and the income has pretty nearly doubled. My father says that the money invested in my education has been well spent.

As you all are agriculturists perhaps you would like to know something of the part of the country in which a farmer friend of yours is living. The place is only a few miles from the Nepal border so one can see the gorgeous peaks of the snowy Himalayas running all along the north. Early in the morning when the red rays

of the sun glitter on them, the scene is really marvellous. There is a small river running through—it is just on one side of my land. Col. Temple, the earthquake engineer of North Bihar, describes it as a "land-making river". Every year during the rains it overflows its banks and deposits a heavy amount of silt and sand which it brings down from the hills. The people, as you may expect, are agriculturists and do not have enough land to make both ends meet. Naturally most of them are in the grip of money-lenders who take the marrow out of their bones. The rate of interest on money is 20 per cent. and on grains 25 per cent., both at compound interest. I am trying to introduce a co-operative system and pray that God may help me in this cause. The majority of the inhabitants are Hindus but the Moslems also are quite numerous. People live in harmony with one another. A Moslem will call a Hindu "uncle so-and-so" and a Hindu will call a Moslem "brother so-and-so". I wish to invite some of the men who say that Hindus and Moslems can never live together and that "the twain shall never meet". These men, humble as they are, may not have so much material in their heads but they possess great and noble hearts.

My letter is already sufficiently lengthy but I wish to say something to my friends who are the present students of the Institute. I have come to know from students of Institute that the Students' Union is not being managed properly and that there is a narrow party feeling which is trying to uproot the Union from its very foundation. Gentlemen, this news is bitterly painful to me. If you cannot manage an affair like a Union today how in the future will you be able to govern a big business? It is because of such narrow party feeling that most of the municipalties are so inefficiently managed and callous to public good.

To my old friends, I wish to extend my best wishes and to convey my sincere love.

Thank you all. Good-bye, my friends.

Sincerely yours,

A. K. MITRA.

EDUCATION FOR LIFE

[From Agricultural Mission Notes, October, 1936.]

The basic problem of our age is one of education, not the education of supermen to deliver the ideal state through the aristocracy of a ruling class, but the education of the common people and the leadership which is indigenous to the common people. One of the tragedies of our day is the way in which the elaborate school system which is available to so many people stresses scholarship, fosters competition, and stimulates the leadership which emerges to seek wealth and power as ends in themselves. What is needed is a school which will take these people, give them the techniques and inspiration which only a school can give, and send them back as the leaders and servants of the common people of whom they are a part.

This, precisely, is what the Danish Folk High School or People's School undertook to do nearly a century ago in rural Denmark. The People's Schools grew out of the teachings of the great Danish prophet, Grundtvig, a scholar, a poet, and a theologian whose philosophy of education still dominates the People's School movement in Denmark and elsewhere, aad whose ideals for his people have become a part of the philosophy of life by which the Danish people live.

One of the faults which Grundtvig saw in the free society was that the people, apparently content with political freedom, were not sufficiently resolute to create free schools and a free culture. He found that the prevailing educational system served the interest of scholars only. "We are immeasurably rich in ideas, but great beggars in reality, rich in knowledge, but poor in vital force."

In the period of young adulthood, from eighteen to twenty-five years, Grundtvig recognized that there was in most people a moment of "spiritual creation" which is the richest opportunity which any educator could want.

There is the moment when the slumber of youth and adolescence is over and the young adult embarks upon maturity. The primary aim of education in this period should not be scholarship. 'Scholarship is one thing," wrote Grundtvig, "and education and fitness for life is another; they may well be united, but not in the case of the majority; they must not be hostile to each other; they must be kept separate, otherwise they seek to drive each other out and necessarily spoil each other. Scholarship will lead scholars astray if it is not confronted by an education of the people which obliges it to take present-day life into consideration, just as the education of the people will soon degenerate into a superficial polish if scholarship does not keep it alive." Schools for scholars have been amply provided, then as now. Grundtvig evolved his plan that there must also be schools which are primarily concerned with the spirit and the emotions if any "vital force" is to be imparted to the people at large. Given the great urge to take the implements of a free society into their hands, they are then prepared to live and to learn the vocations and the techniques with which they will find their useful places in society.

Out of the writings of Grundtvig two doctrines emerge which may leave their stamp upon the free schools of the world for some time to come. The first of these is his concept of the functions of the school for life. On the one hand it must aid the individual to unfold his own potentialities to the full, "to awaken, nourish and enlighten human life. 'Know thyself' is the right inscription above all school doors." Then the school for life must fit him for active and constructive membership in the civic community. How is the school to do this?

What shall be the sources of its power to give life a vital force? Grundtvig gave three media: history, native language, and song. History, taught as the inspiring and creative experience of men and not as dates and events, was in everything, as all teaching was related to the stream of life of which the student was to be made a part. Native language—the student must speak and

write it, thus the leadership of the people of Denmark was made articulate. And song—every lecture started with a song—not sentimental jingles but songs of great meaning for the young people of Denmark. The Danish hymnal of today is filled with hymns from Grundtvig's pen.

The second of the doctrines of Grundtvig which have had great influence on the people's schools is the doctrine of "the living word." He taught that only the spoken word can convey life from one person to another. The written word, to the great majority of people, is ineffective in this work of giving life. Once the bond is established, the written word may buttress or extend a conviction, but the first impulse of life must be the spoken word.

Out of these doctrines a three-fold statement of principle has been distilled from the writings of Grundtvig which has much of the flavour of biblical passages: "The Spirit is power;" "The Spirit speaks through the living word;" "The Spirit speaks only in freedom." Simple as these precepts are, out of them have grown People's Schools which have given a better life to the common man. Now there are sixty such schools in Denmark and one-fourth of the young people of the country attend their short three to five month courses.

Briefly the method and aims of the People's Schools may be summarized as follows:

1. The emphasis of instruction is upon the awakening of the spirit, rather than upon the acquiring of knowledge or skill.
2. The method of instruction stresses the "living word"; lectures and discussions in which there is life are the principal programme.
3. The historical approach characterizes all instruction, even the sciences, and history is a living subject.
4. The subject matter is confined largely to those subjects which are useful to the average man in his personal or civic life.

5. There are no grades, credits, degrees, or examinations. The primary emphasis is upon instruction and not on competition between students.
6. The fact of a group of students living together is utilized as a fundamental educational medium. The teachers utilize this opportunity by living with the students and using their influence to create a co-operative community.
7. The schools are dominated by a high ethical purpose. They seek to give the student the opportunity to know himself and to supply him with the motivation to exert a constructive influence in all relationships of life.
8. The schools furnish an incentive to leadership which is loyal to the people's cause. No effort is made to attract people who aspire to scholarship or wealth or power for their selfish advancement or enjoyment.

The Denmark toward which the efforts of Grundtvig and his followers were directed was a land of despair. The depredation of war and the loss of part of the country to Germany had left the land poor in material wealth and depressed in spirit. A change in agricultural markets during the nineteenth century had cut away the established agricultural export business and had left the farmers in a condition which seemed hopeless. It was in this setting that the people's schools undertook to bring a better life to the farming community of Denmark.

How have these schools influenced the national economy and culture ? In a brief statement it is difficult to make any careful appraisal of their effect. While the People's Schools did not teach any political or social formula and made no concerted propaganda for any particular cause, they gave the great incentive from which many social movements sprang Without any direct urging of a particular line of action the effect of

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the People's Schools was principally to awaken the young people and to give them the techniques of leadership embodied in native language, history and the social sciences. No description of subject matter would convey the fact that there is life and purpose and a will to better the lot of the common man in these schools. What the school did was to prepare the soil, in which the great people's movements could thrive. The Danish farmers, given the People's School preparation, have made their democracy effective by extensive organization for political action, for consumer's cooperation, and for farm marketing cooperation.

Condensed with permission from Consumers' Cooperation, September, 1936.

The management of THE FARMER is interested in discovering whether there has ever been published in India an edition of "Wealth of Nations" by Adam Smith. If there is an Indian edition of this book we are eager to learn of it, and would appreciate it very much if anyone having such information would communicate with the Editor.

Hybrid citrus varieties are becoming increasingly important. Some varieties of tangelo, a cross between loose-skinned oranges and grapefruit, are being grown commercially. A recent California bulletin calls atttention to four new varieties which are said to be worthy of trial. Three of these are hybrids of different types of loose-skinned oranges, while the fourth is a chance seedling from the Washington Navel. It does not have a navel, and is considered promising for the warmer regions where the parent variety does not thrive. The three hybrids are said to possess new and attractive flavours. There is a wide field for experimental work in India where there are many different types of citrus fruits. The possibilities of crossing the Santra with other species are great.

TILLAGE AND POWER

By Dr. B.A. Keen, F. R. S.

(*Assistant Director, and Head of Soil Physics Department, Rothamsted Experiment Station.*)

If a farmer of mediæval times could by some miracle visit present day farms, he would see, amidst much that was new and strange, one batch of old friends—the cultivation implements. His initial diffidence in claiming acquaintance with such new elegance—everyone goes cautiously with friends who have risen in the world—would not long survive his instinctive feeling that, at heart, they were unchanged. After all, these implements, in their essential features, were evolved a long time ago to invert and to stir the soil, while being drawn through it at the natural walking speeds of oxen at first, and later of horses. The many valuable improvements in design and efficiency do not disguise the close relationship of the modern three furrow self-lift tractor plough to its crude oxen-drawn ancestor. Their differences are those of degree, not of kind.

It is, of course, true that the modern farmer can produce a seed-bed or a tilth with greater ease and certainty, and more quickly than his ancestor could; but it is equally true, as the Rothamsted experiments on soil cultivation have conclusively shown, that the character of the tilth is still primarily controlled by the preceding weather conditions; for example, on medium and heavy soils the absence of hard winter frosts and drying winds will produce difficulties in spring cultivations that the implements cannot completely overcome.

The greatest benefit that power-haulage of implements has conferred on the farmer is in the speed of work. Full advantage can be taken of short favourable spells of weather in tricky seasons, and a tractor may on these occasions make all the difference. Power-haulage of implements enables a large area to be covered in a given time by either or both of two methods; large

implements drawn at a relatively slow speed, or smaller implements at a faster speed. Since large expensive implements are out of the question for the average farm, it is surprising that the second alternative has not been more exploited. The Rothamsted experiments show that the resistance offered by the soil increases only slowly for a marked increase in speed of work. Naturally, greater power would be needed to propel the tractor along at an increased speed, but the calculations could ignore the small increase in resistance that the soil would offer to the implements. It may fairly be suggested that the tradition that soil cultivation is unsatisfactory, unless done at speeds of 2-3 miles per hour, is due for a critical examination.

In fact, quite apart from the scientific arguments, the pressure of economic conditions demands that such an investigstion should be made. Cultivation costs are by far the heaviest single item in the arable farmer's budget. The days when a farmer could afford to be an artist in this matter of cultivation—cross-ploughing, harrowing again and again until he got the perfect result—are gone for ever. For this reason, the Rothamsted cultivation experiments from 1926 onwards have also embraced a study of cultivation methods to see whether they can be cut down or telescoped without detriment.

The general conclusion is that many of the statements still made in text books on practical agriculture as to the virtues and effects of cultivations are unjustified. It appears that cultivations beyond those necessary to keep down weeds are often a waste of time and money. Several experiments on both light ana heavy land were made to see whether kale and sugar beet profited from inter-row cultivations additional to the minimum needed for keeping down weeds, with the disconcerting result that the extra cultivations produced an actual decrease in yield. Again, the virtues of subsoiling are shown to depend on the nature of the soil; in some areas subsoiling is a waste of effort. Numerous trials at Rothamsted

produced such little effect that finally the subsoil was well dug with a hand fork and the yield of sugar beet compared with that on the plots where the subsoil was undisturbed. No increase was obtained, even with such a thorough subsoiling.

The general conclusion, which is confirmed by other workers on different soils, is that cultivations in excess of those needed to allow the weather to act, and to keep down weeds, are in general a waste of time and money.

The question of telescoping two or more separate cultivation operations into one leads at once to the subject of rotary cultivation, which our resurrected mediaeval farmer would certainly find new and strange. Rotary cultivation can justly claim to be a revolution, and, like all drastic changes, some time must elapse before its effects can be fully understood and exploited. Already it has branched out in two directions: the rototiller, whose use in orchards, market gardens and on light land has passed the stage of experiment; and the gyrotiller, which is now well established in regions where steam cable sets once held undisputed sway.

However, there still remains a third and most important possible direction of advance for rotary cultivation, as a substitute for the traditional implements in medium and heavy land arable farming. Numerous experiments have been made to this end on the Rothamsted land, with results that, although not yet fully conclusive, are most encouraging. Yields of cereal and root crops with rotary cultivation are equal to those with the traditonal methods. The main problems to be overcome are the looser tilth and the increase in weed numbers. The experience of several years' experiments with the new method was utilised in the design of a comprehensive trial begun in 1933 to last over several rotations. This experiment will provide, both for cereal and root crops, a rigid comparison between the new and the older methods over a variety of weather conditions.

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FAREWELL TO DAIRY STUDENTS

By a Present Student

On November twenty-first the outgoing dairy students of the Institute were entertained at tea by the staff and students of the Allahabad Agricultural Institute.

A group photo was taken with the dairy students in a prominent position in the group. As remarked by the Principal, it will be a historic picture because it is the first one with women students of the Institute in it. These students of the home making course for women heartily co-operated with the other students in the farewell party.

Tea was followed by a short meeting in which Dr. Higginbottom presided. Two of the present students gave farewell speeches. They brought the recollections of many happy occasions they had known in the hostel through which the outgoing dairy students had showed their love and co-operation in making hostel life more pleasant. One of the speakers mentioned the fact that these dairy students will be greatly missed in the hostel. But he said that it is a matter of joy because the dairy students were going out to serve their country. "Improve the lot of agriculturists and improve the breeds of Indian cattle", said His Excellency the Viceroy in his first speech. These dairy students are going out to do just that.

In reply to the farewell speeches one of the outgoing students gave a short but meaningful reply in which he stressed the important point that they are not going out to increase the list of the unemployed. He said this with confidence because he said that the training they got here was such that they can do some work in the line they were trained.

Finally Dr. Higginbottom made his concluding remarks. He made a passionate appeal to the student body that it is their duty to keep this Institute going. He said he is getting old and that he firmly believes that the students of this Institute, past and present, will give a helping hand to the Institute in times of need.

The meeting then came to a close.

CLEARANCE OF AGRICULTURISTS' DEBT

We reprint here this article which appeared in the November 26th issue of the SERVANT OF INDIA in an effort to help disseminate information as to steps beiug taken encouraging debt conciliation. THE ALLAHABAD FARMER has no comment to make, either of approval or disapproval, on the views expressed in this article.

Travancore State, unlike the provinces in British India which have set up debt conciliation boards, is prepared to make financial provision for the liquidation of debts to be conciliated by similar boards which the State intends to establish after the passing of the Agriculturists' Relief Bill which was recently given a second reading by the State's legislature. The boards are to attempt conciliation on a voluntary basis, but the State expects that there will be a considerable reduction in the total amount of debt if the creditors are not left to recover the compounded debt from the debtors but are paid in cash or in bonds. The Agricultural Debt Redemption Committee which the State appointed expressed its opinion that no scheme of debt conciliation would succeed—

> unless some agency like the Government or the co-operative credit societies or land mortgage banks where forthcoming to make cash advances to the debtors in order to enable them to pay the compounded debt, at least in part, to the creditor ....It is from this point of view that we have considered it necessary to recommend the expansion and reconstitution of the Land Mortage Bank as an essential complement and counterpart of debt conciliation. The Bank should be provided with adequate funds to meet the large demands that may be made on it in consequence of the operation of the boards. The funds that would be required may be placed at the disposal of the Bank, to some extent in cash, but mainly by issuing debentures. Debentures may be issued to the extent of the conciliated amounts, provided the security offered by the debtor is adequate for the purpose.

This recommendation the Government is prepared to carry out. The debt conciliation boards will work hand in hand with the Land Mortage Bank: the boards will, if possible, bring about an amicable settlement of the debt, and the Bank will provide the wherewithal for carrying the settlement into effect. A Press communique issued

before the publication of the Bill made the announcement:

> Government are further pleased to direct the Land Mortgage Bank to advance money whenever a debtor and all his creditors have agreed to bring down the total debt to the amount that may, according to the rules of the Bank, be advanced upon the security of the immovable property that is offered by the debtor. Preference will generally be given by the Land Mortage Bank to applications for loans consequent on such conciliation.

Government does not give a statutory guarantee that the Bank will make loans to all the debtors whose debts will be compounded by the boards, but it feels confident that the Bank will be able to do so. Asked if the Bank can meet all the demands that will be made upon it, the Law Member replied, "If the security is ample the Bank can, I believe; and the Bank may raise money by issuing debentures to the creditors themselves." The Law Member was further asked, "Suppose the Bank is not able to meet the demand?" and he said, "It is hoped by Government that such a contingency may not arise." The fact is that Government is willing to raise a sufficient loan for the purpose (the estimate of the bankers is Rs. 50 lakhs) not directly, but indirectly through the Bank, and after all the Land Mortage Bank is a State Bank. The debtor mortgages his entire property to the Bank, and there is no reason why, if the conciliation of debt proceeds on proper lines, the Bank should come to grief. Mysore State also undertakes to provide for the supply of money required for debt conciliation. Government's order on the subject dated 30th October, 1935, states: "When a settlement is arrived at, the (Debt Conciliation) Board will attempt to arrange payment to the creditors of the amounts of their debts as settled through a land mortage bank or a cooperative society, and where this is not possible the amount due will be recovered by the Deputy Commissioner as an arrear of land revenue." Thus, both in Travancore and Mysore payment will follow immediately upon settlement and the States will practically take over the conciliated debts, and will not, after reducing the debts, leave the creditor to his own devices. In these States, therefore, it may be confidently expected that, as in Bhavnagar,

the debts will be reduced as a result of conciliation, though it be voluntary, to about a quarter of the computed debts.

What are the principles on which on which debts can be equitably reduced? It is perhaps not necessary to lay down these principles where conciliation is on a purely voluntary basis. Since both the debtor and the creditor agree on a particular figure, it may be presumed that the figure is not unjust to either party. But no legislation that has so far been passed or is about to be passed is altogether free from an element of compulsion, and where compulsion is resorted to it is but proper that the criteria of a fair settlement should be stated with as great an approach to precision as possible. The Debt Conciliation Acts of the Central Provinces, the Punjab and Bengal, though they provide mainly for voluntary conciliation, have also a small element of compulsion in them, for it is provided in them all that if the creditor does not agree to a debtor's "fair offer which the creditor ought reasonably to accept," certain penalties are imposed upon him. When he will file a suit for the recovery of his debt, the court will not allow him any costs or any interest in excess of simple interest at 6 per cent., and, further, if the suit is in respect of an unsecured debt, execution of the decree passed in the suit will be postponed till all the debts in regard to which the creditors agree to conciliate are paid off. In spite of such provisions which must exert a strong coercive effect, no definite principles on which conciliation should be effected are embodied in the Acts of these provinces. This is a lacuna which needs to be filled up in order that every one should understand how a settlement will be attempted by the debt conciliation boards and what offer of the debtor they will consider fair. The Agriculturists' Relief Committee in Mysore made a recommendation on this point. It said:

> We consider the debt conciliation boards should be guided by certain definite principles in arriving at the amounts for which debts should be compounded. We, therefore, suggest that the following

aspects should be considered by the boards in arriving at a decision:—

(*i*) The amount of consideration actually received;

(*ii*) The reasonableness or otherwise of the rates of interest contracted for;

(*iii*) The amount of interest that has been allowed to accumulate;

(*iv*) Onerous conditions, if any, that have been coupled with the grant of loans; and, lastly,

(*v*) The repaying capacity of the debtor.

If we consider that the function of debt conciliation boards is twofold: to ascertain (1) what the amount of the debt properly is and (2) at which figure it should be compounded in view of all the surrounding circumstances, it will be seen that the first four tests mentioned above relate to the first part of the board's function and the fifth relates to the second part, and it is this fifth test which is the most important. An officer appointed by the Madras Government to inquire into agricultural indebtedness, Mr. Sathyanathan, in his report accepted these as the correct tests but added two more of his own, viz.

(*vi*) Whether at any time the creditor was offered settlement of the debt in full or part and the offer was refused;

(*vii*) The difference in value of the debtor's property and of staple food crops between the time when the debt was incurred and the time of settlement by the board.

The Madras Debt Conciliation Act based upon this report accepts most of these tests, for the section dealing with this point is as follows:

The board, in coming to a decision whether the offer made is fair or not, may take into consideration—

(*i*) The fall or rise in the value of land and its produce, in the locality;

(*ii*) The amount of consideration actually received;

(*iii*) The reasonableness of the rates of interest;

(*iv*) The onerous conditions, if any, subject to which the loan was granted;

(*v*) Whether at any time, the creditor or the debtor was offered settlement of the debt in full or part and if so what the terms were; and

(*vi*) Any other particulars which the board thinks it desirable to take into account.

But it will be seen that the Madras Act omits the most important test, viz. the ability of the debtor to pay off the debt. The report of the Select Committee on the Cochin Debt Conciliation Bill, which is to come on for debate in the Legislative Council this week, accepts *in toto* the tests laid down in the Madras Act. The Travancore Agriculturists' Relief Bill has the following clause in this connection:

> In proposing and making the conciliation, the board may take into consideration the following, *inter alia*, namely:
>
> (*a*) the equities of debt transactions concerned,
>
> (*b*) the amount of each of the debts,
>
> (*c*) the amount of interest already paid, particularly after the year 1105 M.E. (1929-30, the year of the onset of depression),
>
> (*d*) the amount of the interest that has been allowed to accumulate,
>
> (*e*) the duration of the transactions,
>
> (*f*) the character of the debt, as for example, whether it is secured or unsecured.
>
> (*g*) the ability of the debtor to pay,
>
> (*h*) the availability of assets out of which the debts may be realised,
>
> (*i*) the occupation, needs and other economic condition of the creditor,
>
> (*j*) the needs of the debtor and the necessity for leaving, as far as possible, a margin of property for the debtor's subsistence.

Here the most important items to note are (*a*) and (*j*), the first and the last. The last takes account of the debtor's right to live and admits the need for leaving enough for his maintenance, and the first makes a clear distinction between law and equity. This brings very prominently to our attention the fact that a debt conciliation board is not a court of law adjudicating upon the question of debt according to the letter of the law; it is concerned with equity and may on occasions set aside the law in view of exceptional circumstances to which, however, it is outside the province of a court of law to pay any heed. Seeing that a board is given all the powers which the courts possess of summoning parties and witnesses with the production of necessary documents, etc.,

one is likely to think that boards are merely a reproduction of law courts. In fact, in the Travancore Sri Mulam Assembly, a member asked what the difference was between the functions of the boards and law courts, and the Law Member said, "The court is not a conciliation board. The court is a court to decide according to strict laws....(But the boards) apply their own sense of equity and fairness having regard to the peculiar circumstances of each case and come to a conclusion as to what shall be the conciliation applicable to each case." This is a point of great importance which is often lost sight of by those who are considering this question.

The Travancore Bill is in some respects more advanced than legislation adopted elsewhere, but in some other respects it is more backward. No maximum limit of debt which is to be subject to conciliation is fixed in the Travancore Bill, but on the other hand in order that conciliation on a voluntary basis can take effect all the creditors of a debtor must agree. In the C. P. Act it is enough if creditors to whom 40 per cent. of the total debts are due come to a mutual agreement with the debtor, the rest of the creditors being subjected to the penalties of loss of costs, interest of more than 6 per cent., etc. Such a limit is put in legislation of a voluntary character in order to prevent collusive action on the part of the debtors, but even this comparatively low limit of 40 per cent. embodied in the C. P. Act is found in practice to be too high. For instance, the Chairman of the Narsinghpur Board reports:

> The 40 per cent. limit prescribed by section 12 has disabled the board in some cases from giving relief to a debtor who could easily pay off his debt within a reasonably short space. The creditors in such cases being sure of recovering every pie of their claim through the civil court were found to have made a common cause to ruin the debtor by putting up a joint front. The section may be made more useful in serving the object of the Act if amended so as to reduce the limit to 10 per cent. if not done away with altogether.

Mr. Darling an eminent authority, supports this view. In commenting on the Chindwara Board, he says:

> Section 12 of the Act provides that the creditors to an amicable settlement must not have less than 40 per cent. of the total debts due to them.
>
> There should be no limit as it leads to abuses, money-lenders combining collusively or perhaps one money lender persuading another not to agree.

A provision meant to prevent collusion on the part of debtors is actually found to encourage collusion on the part of the creditors, although the limit laid down in the C. P. Act is only 40 per cent. Imagine the effect if it is provided that cent per centum of the creditors must agree. It must be said, nevertheless, on the other hand that even if no creditor agrees the conciliation board in Travancore may certify that a debtor had made a fair offer and that the creditors had refused it, and the Court will have to take this fact into consideration when it considers a suit in respect of such a debt.

A very useful provision in the Travancore Bill is the one relating to a heavily indebted debtor who has not enough security to offer to the Land Mortgage Bank. For the benefit of such debtors the following method of conciliation is provided in clause 15 (*b*):

> That a portion, say, one fourth, of assets of the debtor be left to the debtor free from all liability for his debts, and the balance left to the creditor or creditors to be appropriated by them or to be sold and the sale proceeds distributed amongst them, it being also laid down how the property or the sale proceeds, as the case may be, shall be distributed amongst the creditors, if there are more creditors than one.

This is a sort of insolvency measure adapted to rural conditions: if the debtor has assets on the security of which the Land Mortgage Bank can lend to wipe off his debts, the Bank advances money to him; otherwise he is sold up, leaving however one-fourth of his property to him for his own and his family's maintenance. No debt conciliation law can be complete unless it is accompanied by a provision for the relief of such debtors as are not solvent and cannot be rendered solvent even after a large-scale reduction of their debts.

OUR FORMER STUDENTS

DEAR FRIENDS:

We, the Old Boys who are employed in the Agricultural Institute, feel that probably all Old Boys would like to have up-to-date information about their Alma Mater and we are therefore sending you this letter. Those of our alumni who have had the opportunity of paying a recent visit to the Institute must have been proudly impressed by the marked improvements which have been made and which are even now taking place. Each year finds the Institute a different place from what it was in the previous years.

To our great fortune, Dr. Sam Higginbottom continues to be the Principal. The very mention of his name will bring to you his dynamic force, charming personality, and fatherly love for all his students, and with him Mrs. Higginbottom continues to give of her time and love to the work of the Institute. They have been here for many years, yet they are in sufficiently good health to pilot the Institute foı many years to come.

Among the other staff members, Mr. and Mrs. Hayes are working on with increasing zeal, Mr. Hayes as Vice-Principal and horticulturist, and Mrs. Hayes as the Institute physician being helpful to all and devoting especial attention to the womenfolk on and around the farm. Mr. Vaugh, the agricultural engineer, is on furlough in America this year and is due back next August. Mr. A. T. Mosher, a young and promising American, is working in his place. Mr. Ira Hatch is the farm manager, using his unique practical experience in levelling, irrigation, and drainage. The good teacher, Mr. A. P. Brooks, is head of the chemistry department. Dr. B. H. Schneider, who stands very high in India as an expert in animal nutrition and breeding is head of the department of animal husbandry. In securing Dr. E. F. Vestal recently the Institute has filled a long need for a competent plant pathologist.

There are many valuable individuals on the Indian staff. Mr. B. M. Pugh, though a teacher of various subjects, is primarily head of the agronomy. He is this year on special study leave at the Institute of Plant Industry, Indore, and will rejoin the Institute next July. Mr. W. K. Wesley is the Institute entomologist Mr. N. R. Joshi continues to be the dairy manager. Mr. C. O. Das is assisting Mr. Brooks.

A very important event in the history of the Institute was the amalgamation into the Allahabad Christian College. This College, of which Dr. Sam Higginbottom is the President, Dr. C. H. Rice the Principal and Rev. J. W. Prentice the Treasurer, is comprised of Ewing Christian College, Jumna Mission High School, and Holland Hall University College in addition to the Agricultural Institute. Among other economies this amalgamation has resulted in considerable exchange of teaching which has brought Dr. B. B. Malvea, and Messrs. N. K. Sur, U. S. Varma, William Ferry, and B. W. Fuson from Ewing College to teach in the Institute and has taken much of Dr. Vestal's time for teaching at Ewing College. A long cherished aspiration was fulfilled with the affiliation of our Institute with the Allahabad University. The first batch of B. Sc. (Agr.) students passed in 1934 with cent. per cent. success.

This year finds the largest student body in history studying at the Agricultural Institute. The hostel is packed with over 140 students, about thirty of whom are first year candidates for the Indian Dairy Diploma. At the same time the Institute has opened a women's department for the teaching of home-making. This step, which is a fulfilment of Mrs. Higginbottom's dream of many years, is perhaps the most important of the current year here at the Institute. It is hoped that many wives and sisters and daughters of old boys will come to benefit by the training which this course has made possible.

Not only in students enrolled but in work attempted this is becoming the greatest year for the Institute. Dr. Schneider and Dr. Higginbottom have arranged several

co-operative research projects with the Imperial Council of Agricultural Research and with the Harcourt Butler Technological Institute in problems of animal nutrition and milk composition. The horticultural department is going ahead with experiments in fruit culture and preservation. The orchard of American grapefruit at the Institute is a beautiful thing to behold. We are fortunate in having the largest agricultural engineering building in India. This department along with other creditable work has developed and is manufacturing the Wah-Wah plough and the U. P. plough, each with different attachments especially adapted to the conditions and pocket of the average Indian village cultivator. The farm department added 300 acres of land to its former area in 1932 and the soil reclamation project has proceeded even more rapidly than before. Of what was once the poorest land we have built up about one-third of the farm area into a first class section producing more than four fine crops each year.

We feel very strongly that the old boys of a college which is growing and accomplishing great work as this one is, should be bound closely to their Alma Mater. We believe that the rest of the Old Boys share these views. We believe that the fact that we are products of this Institute gives us the honour and opportunity of taking part in its continuing work. For each of the last three years the Institute Student Union has appointed and celebrated an Old Boys' Day. This year the third of December was the celebration. It was a thrilling occasion with the old and new students and the staff meeting together in brotherhood and fellowship, exchanging ideas and experience, the new boys playing the part of hosts and the old boys the part of guests. How wonderful this occasion could have been, had all of the alumni of our Alma Mater been together in paying our hearty obeisance to our beloved Institute.

We feel that this is the time for us to have a full-fledged Old Boys' Association On the third of December a local committee of Old Boys was formed to communicate

with all other Old Boys to learn whether or not they share in this conviction. This letter is our invitation to you to write to us giving us your views on this subject. Do you agree that Old Boys of such an institution as ours is should be organized? If so, how would you like to see this organization carried out? Whom would you like to see made responsible for the organization? Do you think it would be possible for a great number of us to get together some time this year to discuss the matter? We shall be waiting to receive a reply from you.

Very sincerely yours,
Old Boys' Local Committee.

G. Q. VACHOO—*Convener.* M. J. ZACHARIAH. D. S. MANGAT.
A. D. CHAND. A. S. RATHORE. S. R. MISRA.
A. T. MOSHER. S. C. BHAGAT. T. A. KOSHI.

P. S. While you are writing please tell us something about yourself, where you are living and what you are doing. Other Old Boys will be anxious to hear from you and if you will send the information to us we can pass it along. The Principal also asks that we especially request those who do not have employment or who would like to change employment to keep him informed as to their location and desires, as many requests come to him to recommend suitable men for agricultural positions. Please let us know about yourself.

We have recently received a copy of a booklet entitled "Rural Reconstruction" by Mr. N.G. Apte, B. Ag., Dairy. This booklet is a compilation of papers and lectures given by the author in his work of rural reconstruction. The opinions which he expresses are many of them individual ones and are often different from the ideas commonly associated with intelligent rural reconstruction. It is a booklet which, because of its individual opinions will be read by those interested in the problem of rural development, as they are opinions growing out of actual contact with the villages of a particular area.

CITRUS FRUITS OF INDIA

(*Continued from page 8*)

size, very short pedicelled, often hanging down from the axil of the leaf, and the petals do not spread open nor are they recurved. The filaments are much united and anthers are very short. The fruit is yellow, moderately large in size, slightly depressed and very aromatic, but the aroma is much different from those of *Citrophorum*. The oil cells of the rind are large, balloon shaped and rather uniform in size. The segments are loosely attached, the central column is hollow, the pulp is very juicy and acid, and the vesicles are very delicate having an extremely thin wall. Seeds are very large and plump, shorter and broader than any of the former subgenera, containing nearly white embryos. This is perhaps the only group in this subgenus having white embryos, but in some cultigens. they are greenish as in other mumbers of the subgenus. The representative species, *Citrus junos* Sieb, ex Tanaka, has a very wide distribution, and reaches almost to Burma, as appearing in Tseku in Yunnan, at 28§ N. Lat. (6,540 feet above sea level).

The second section, § *Acrumen*, is the loose-skin orange proper, having flowers of similar character, but leaves without prominent petiole wings, and fruits more depressed, deep orange coloured (sometimes vermillion, rarely yellow), and sweetening later in a majority of cases. The oil cells of the rind are generally much graded and the pulp vesicles are generally more secure, deeper coloured and sweeter than in other sections. The acidity is not strong except in small-fruited wild, or semi-wild species. Seeds are not very large, plump, beaked at the base, and green embryonic. There are two sub-sections involved in the section, which will be discussed later.

The third section, comprising the single species. *Citrus microcarpa* Bunge, has peculiar obovate leaves with long linear petioles and obsolete reticulation, small

round orange-coloured fruits containing very acid juicy pulp composed of very finely netted extremely delicate pulp vesicles. The tree habit is dwarf, the rind is sweetish with a decided, kumquat aroma, and the finely striated oblong seed contains very deep green embryos. These characters approach those of the members of the genus *Fortunella*, so that the group is called § *Pseudo-fortunella*, as mentioned before.

4. Sub-sections of the loose-skin orange proper.

The loose-skin orange proper comprises two distiuct sub-sections; (1) *Euacrumen* and (2) *Microacrumen*. The former sub-section is represented by the king orange, *Citrus nobilis* in the sense of the original namer, Loureiro. It has a large stature, large thick leaves with strong venation, large flowers with recurved petals and large fruit having a large well-lobed calyx. These features are somewhat analogous with the section Aurantium but the sub-section keeps strictly its fundamental characters of the subgenus, i.e., the solitary flowers, flattened fruits, loosely attached rind and segments, and greenish embryos. The petiole wing may develop to a certain extent, the rind may become fairly thick and the colour of embryos may fade into cream colour, but the pulp vesicles never become elastic and elongate to an appreciable degree. This sub-section involves a very important Citrus fruit almost entirely unknown in India :—The Satsuma orange of Japan, the Gulf States of the U. S. A., Crimea and Algeria, the annual production of which is valued at more than twenty-five million rupees. The author has seen a few trees of this particular Citrus in Lalbagh Gardens in Bangalore, promising a very hopefnl future. The king orange was also met with in the U. P., but the fruits were very poor due to the dry climate.

The latter sub-section involves all other loose-skin oranges somewhat closely related with each other. They are all bushy trees or ramous shrubs in habit with comparatively small sized leaves more or less emarginate at

the tip. The wing of the petiole never develops and the venation of the lamina is very fine. The flowers are small, the petals do not spread very wide, having white, not recurved petals. The fruits are fairly large to very small, but the rind is generally thin and the oil cells often reach the inner surface. The colour of fruit may be vermillion or deep yellow and that of the pulp may be orange or yellow ochre. Pulp vesicles are nearly always short grained, polygonal, thin walled and tenacious, and the seeds are smooth, round-tipped and beaked at the base.

The large-fruiting members of this sub-section are represented by the Suntara (Santra) of Poona, Nagpur and the Punjab, the proper name of which is *Citrus chrysocarpa* Lushington. This is cultivated in most Citrus producing centres in India, Ceylon, Java, Formosa, Kuwangtung and Lower Fukien in China. The industry based upon this species may amount to an extent at least one half that of the Satsuma orange. The plant is very ramous and upright-shooted, and the fruit is globose, deep orange coloured and characterized by the presence of regular radial grooves from the stylar end and frequent basal mamilla. Bonavia states that it has the oil cell dots forming miliary convexities, and this expression quite suits the facts. There are several other Citrus belonging to this sub-section. The Keonla of Bonavia, *Citrus crenatifolia* Lush., is generally called Kawla in Poona, Saharanpur and Lahore and is different from the Suntara as is fully discussed by Bonavia. The fruit has a more rectangular outline, thicker skin, lighter colour, a smaller central column and the pulp vesicles arranged in a herring-bone structure and of decidedly inferior quality and different taste. The Ladoo of the same locality is again a distinct species, *Citrus paratangenrina* Hort., having a reddish skin, large basal mamilla with 5 feet deep pond-like grooves, a very broad apical depressed area, peculiarly flattened outline resuming depressed obconical shape, more or less chagrined thin rind, decidedly apiculate carpel end (in transverse section of fruit), soft pulp of somewhat earthy taste, containing many seeds with a less greenish

colour outside, less beaked base, deeper coloured tegmen in comparison with the Suntara. The writer does not know if there is any locality in India planted with these two species on a commercial scale.

There is another loose-skin orange, economically raised in Cuddappah District in Madras, which is identical with the tangerine of the New World, *Citrus tangerina* Hort. This resembles the Ladoo but the basal mamilla is smaller, the outline is regularly depressed globose, and it has a very smooth vermillion skin, sweet but chalky-flavoured pulp and long beaked smooth seeds. This is a commercial species, extensively raised in Florida (Tangerine), Fuchow (Gai or Fukieh), Australia (Beauty of Glen Retreat) and Japan (Oobeni). It is unknown in any other part of India and is not found in any nursery. There is still another kind of the loose-skin orange with a peculiar fate. That is the Mediterranean Mandrarin imported from Europe. The writer met with this species, *Citrus deliciosa* Tenore, several times in North Western India but no definite name was told. The plant is well characterized by very narrow crowded leaves, as shown by an American name "Willowleaf Mandarin". The fruit is about the same size as the preceding three species, but is very much lighter in colour and lacking a distinct basal mamilla. It has fine basal grooves, a large number of segments, soft deep yellow pulp, coarsely netted vesicles and large smooth plump greenish seeds. This species is nearly forgotten in India but since it is definitely recorded by Bonavia, the author's rediscovery is of great interest. There are no more fruits of *Microacrumen* attaining to the size of five already given kinds, having a diameter of more than 6 centimeters ($2\frac{1}{2}$ inches).

It is to be noted that there are a few more loose-skin oranges cultivated in India somewhat on a commercial scale. The first is the Kokni orange of N.W. India, *Citrus Kokni* Hort., the fruit of which may reach to the size above mentioned, but generally not bigger. The shape is tall depressed-globose, regular in outline, with a sharply

sinuate apex. The rind is orange coloured, finely pitted, and brittle, the pulp is of the same colour, very coarse grained and acidulous, and the seeds are broad and flat, coarsely netted without a basal beak. This is perhaps a wild orange in Coorg, where it is called Kodangithuli. The second is the Reshni orange of N. W. India, *Citrus, Reshni* Hort., also known in Cuddappah District in Madras under the name *Chota Kitchlee.* It is identical with the Cleopatra orange of the U. S., the fruit of which attains to a similar size but is very irregular in shape, wrinkled all over the surface when it reaches full size. It has a thicker skin, wide open centre, short and broad segments very much lunate from the side view, acidulous pulp, and similar vesicles and seeds as above with much deeper colour of tegmen. The third is much taller, nearly globose vermillion orange, called in Assam *Soh Siem* and is known nowhere else. This is essentially identical with *Citrus erytheosa* Hort., of China and Japan, the commonest orange in the Yangtze River region (Chu Ch'ieh, Chu Sha Ch'ieh, Kobeni), but differs in lacking a deep apical sinus, reconvex stylar end and decided clayey flavour of the pulp. This has few segments, a small central column, finer vesicles entirely not coarse—reticulate as those preceding but elongated and parallel. The flavour of pulp is much better than the former two. The seeds are short and not broad, deep yellow, and faded tegmen colouration not brilliant in tone. No other species are known in India which can be classed in the group of these three.

There are a few more still smaller fruited loose-skin oranges of minor importance. The one is the famous Kinokuni of Japan, *Citrus Kinokuni* Hort., erroneously called *Kymo Kasi* in upper India. The fruit is small, less than 5 cm. in diameter, very flat, deep orange coloured, chagrined and somewhat faintly fluted. The pulp is also deep orange, very sweet, coarsely reticulate, with very few vesicles, and rather large and broad seeds coarsely netted. The oil cells of the rind seldom reach the inner side. This species also occurs in northern Chekiang in

China, and used to be the most important Citrus before the Satsuma became known. There in another related species in India, called *Citrus bengalensis* by a nurseryman in Madras presidency. The fruit is similar in size and shape to the above but the colour is lighter and it is smoother, and thinner peeled, the oil cells not penetrating to the inner surface. The pulp character is very smiliar but is lighter coloured and slightly more acid. The seed is quite different from that of the Kinokuni, smaller in size, not broad and more regularly pointed at both ends, having a very much deeper coloured tegmen especially at the charaza end. The next is a very much wrinkled flat fruit from Parlakimedi Estate in Madras, which is characterized by a very large basal mamilla, deeply concave and areolate apex, and deep yellow surface. In the cross section, it has a moderately thick rind, with small not penetrating oil cells, a large central column, many segments not much lunate in the side view, light-coloured coarsely netted pulp with very short vesicles, and very small oval seeds with pointed ends, light-coloured tegmen, and green monoembryo. This is a very distinct species entirely unknown in China and Japan, but since the author has had no chance to study good sample specimens, and no record was available from Bonavia, it remains still unnamed.

There must be still some more loose-skin oranges which missed the attention of the author during his three months tour in India, for instance, the Butwal orange. Pl. XCIX of Bonavia's book is very doubtful, primarily from the big variation in shape, and secondarily the taste, said to have been the sweetest ever known to him. The latter reminds one of the Suntara from high altitudes, but a fruit the writer received from Saharanpur was a distinct species, very near to his *Citrus benikoji* Hort., of Japan and Korea. More material is necessary to clear up the ambiguity and draw the final conclusion.

(To be continued)

Meteorological Observations

OCTOBER, 1937

Date.	Max. Temp.	Min. Temp	Mean Temp	Percentage of Humidity.	Pressure of the Atmosphere	Wind direction.	Rain for the day.	Rain since Jan. 1	Remarks.
1	94·0	74·0	84·0	76·0	29·44	Calm	Nil	50·0	Harvesting of Juar, Napier, Guinea and Rhodes grasses continued.
2	95·0	75·0	85·0	80·0	29·40	Calm	Nil	,,	
3	96·0	72·0	84·0	72·0	29·44	Calm	Nil	,,	
4	98·0	72·0	85·0	60·0	29·40	E.	Nil	,,	
5	95·0	72·0	83·5	80·0	29·43	N.E.	Nil	,,	
6	88·0	75·0	81·5	80·0	29·48	E.	Trace	,,	Tractor discing and bullock ploughing, harrowing etc., planting Rabi crops continued.
7	93·0	70·0	81·5	63·0	29·48	W.S.W.	Nil	,,	
8	96·0	6[illegible]·0	81·5	62·0	29·54	W.S.W.	Nil	,,	
9	96·0	68·0	82·0	56·0	29·58	W.	Nil	,,	
10	96·0	64·0	80·0	57·0	29·54	W.S.W.	Nil	,,	
11	96·0	61·0	78·5	48·0	29·52	W.	Nil	,,	
12	95·0	62·0	78·5	53·0	29·58	W.	Nil	,,	
13	96·0	63·0	79·5	53·5	29·62	Calm	Nil	,,	Sowing gram, berra started.
14	97·0	65·0	81·0	64·0	29·6	N.W.	Nil	,,	
15	96·0	63·0	79·5	67·0	29·62	W.	Nil	,,	
16	95·0	67·0	81·0	62·0	29·64	Calm	Nil	,,	
17	95·0	65·0	80·0	68·0	29·68	S.S.E.	Nil	,,	Sowing of wheat also started.
18	96·0	63·0	79·5	60·0	29·69	S.	Nil	,,	
19	95·0	64·0	79·5	61·0	29·7	S.E.	Nil	,,	
20	94·0	68·0	81·0	55·0	29·62	N.	Nil	,,	All early potatoes planted by middle of the month.
21	94·0	69·0	81·5	51·0	29·64	N.	Nil	,,	
22	94·0	66·0	80·0	73·0	29·74	Calm	Nil	,,	
23	89·0	66·0	77·5	77·0	29·72	N.	Nil	,,	
24	87·0	63·0	75·0	70·0	29·72	N.	Nil	,,	
25	90·0	65·0	77·5	72·0	29·70	E.	Nil	,,	Sale of fodder in the city continued.
26	91·0	63·0	77·0	69·0	29·72	E.	Nil	,,	
27	92·0	66·0	79·0	77·0	29·70	E.	Nil	,,	
28	92·0	70.0	81·0	84·0	29·72	N.E.	Nil	,,	Spike tooth harrowing and cultivating of some of the potato fields. Harvesting of banda and some other vegetables continued.
29	90·0	67·0	78·5	81·0	29·77	N.E.	Nil	,,	
30	83·0	71·0	77·0	95·0	29·66	Calm	Trace	,,	
31	83·0	69·0	76·0	86·0	29·65		Trace	,,	

NOVEMBER, 1937

Date.	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Pressure of the Atmosphere	Wind direction.	Rain for the day.	Rain since Jan. 1	Remarks.
1	86·0	61·0	73·5	51·0	29·7	E.	Nil	50·0	
2	87·0	62·0	74·5	81·0	29·68	S.S.W.	Nil	„	
3	89·0	59·0	74·0	73·0	29·64	S.	Nil	„	
4	91·0	58·0	74·5	81·0	29·62	N.W.	Nil	„	
5	96·0	56·0	76·0	85·0	29·66	Calm	Nil	„	
6	92·0	55·0	73·5	76·0	29·70	S.	Nil	„	
7	89·0	55 0	72·0	78·0	29·71	Calm	Nil	„	
8	87·0	57·0	72·0	74·0	29·70	Calm	Nil	„	
9	86·5	56·0	71·25	72·0	29·70	Calm	Nil	„	
10	89·0	67·0	78·0	71·0	29·72	N.W.	Trace	„	
11	89·0	66·0	77·5	87·0	29·75	Calm	Trace	„	
12	76·0	64·0	65·0	62·0	29·74	E.	Trace	„	
13	75·0	62·0	68·5	85·0	29·71	S.	Trace	„	
14	82·0	68·0	75·0	86·0	29·72	Calm	Nil	„	
15	86·0	72·0	79·0	79·0	29·72	S.E.	Trace	„	
16	86·0	68·0	77·0	88·0	29·68	S.W.	Nil	„	
17	86·0	67·0	76·5	49 0	29·68	W.S.W.	Nil	„	
18	88·0	67·0	77·5	82·0	29·7	Calm	Nil	„	
19	89·0	64·0	76·5	49·0	29·72	W.	Nil	„	
20	86·0	57·0	71·5	89·0	29·77	Calm	Nil	„	
21	83·0	50·0	66·5	75·0	29·82	W.	Nil	„	
22	81·0	55·0	68·0	63·0	29·8	W.	Nil	„	
23	82·0	58·0	70·0	66·0	29·78	W.	Nil	„	
24	82·0	48·0	65·0	61·0	29·78	S.W.	Nil	„	
25	79·0	47·0	63·0	64 0	29·8	W.	Nil	„	
26	79·0	46·0	62·5	61·5	29·79	S.W.	Nil	„	
27	79·0	47·0	63·0	55·0	29·81	S.	Nil	„	
28	81·5	50·0	65·5	75	29·75	S.	Nil	„	
29	81·0	48·0	64·5	73·5	29·66	S.	Nil	„	
30	81·0	51·0	66·0	50·0	29·69	E.	Nil	„	

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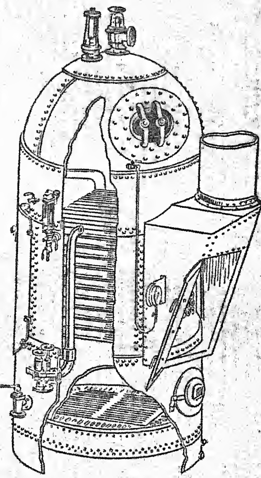

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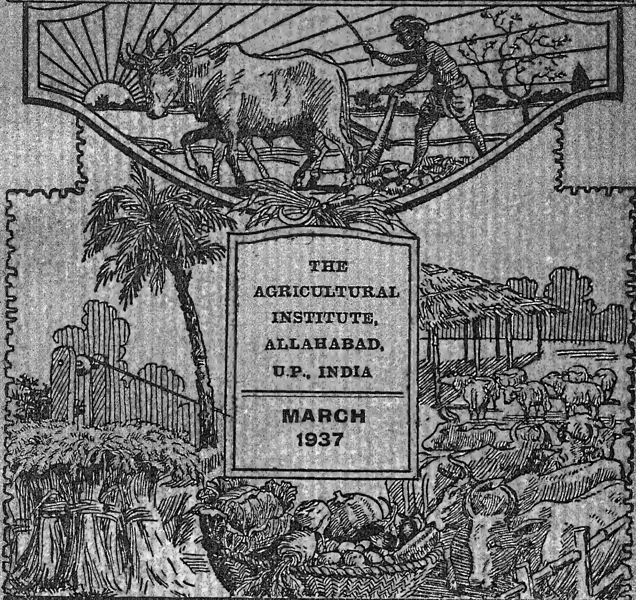
VOL XI] [No. 2

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



"On the labours of the countryman depend the whole strength and health, nay the very existence, of society; yet in almost every country, politics, economics, and social reform are urban products, and the countryman gets only the crumbs which fall from the political table."

—George Russell (A.E.)

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

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Contributions

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Contributors will receive 15 reprints of the article published and additional copies at cost.

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The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

Vol. XI] MARCH, 1937 [No. 2

Table of Contents

THE ALLAHABAD FARMER

Vol. XI] MARCH, 1937 [No. 2

Editorial

The United Provinces are exceedingly fortunate in having an electric grid system in the Western end, where there is an abundant supply of cheap electricity mostly developed at waterfalls on the canals. This cheap electric power is being used not only for electric lighting but also for the pumping of water from tube wells. Hundreds of thousands of acres now have their water supply from these tube wells. What this means to the prosperity of the farmers is difficult to exaggerate. To many villagers it means the difference between starvation for part of the year and a measure of comfort throughout the year.

Sir William Stampe is now devoting part of his time to securing for the Eastern districts of the Provinces somewhat similar facilities to those that the West now enjoys. When these schemes are completed there will be few areas of the earth's surface better situated for improved agriculture and village industries than the United Provinces. Electric power is produced every day in the year, but in a year of normal rainfall there are about four months when electric power would not be needed for pumping irrigation water. I would like therefore for all people familiar with rural conditions in the U. P. to

suggest ways by which this cheap electric power can be used in village and cottage industries. In Japan the village and cottage industries depend almost entirely for their success upon cheap electric power. The beauty of this electric power is that it can be carried within the area to wherever work has to be done. So if there is an existing industry or village within reach of an electric power line, cheap power can be supplied to it.

There are certain conditions which must be observed. It will not do to use this power to produce things for which there is no market. It is better to concentrate on those commodities for which there is a market in the village where the thing is produced. It will take many minds to draw up a comprehensive scheme that is financially sound. I hope readers of THE FARMER who have any suggestions to offer will offer them. A gentleman was in to see me today who says that where he lives they charge four annas a maund for cutting fodder with a *gandasa* by hand, whereas a hand cutter costing Rs. 23 does it for one anna per maund. A small electric chaff cutter should be able to do it more cheaply than a hand cutter. Why should not many of the hand looms in the villages be converted into electrically run looms? Here the weaver with electric power could turn out ten times as much cloth per day as he turns out now.

This cheap electric power points the way to a recovery of village industries. This would bring about greatly improved economic conditions in the villages. It would provide the means of livelihood for him whose livelihood is now very precarious. It would relieve the very great pressure on the land which is so undesirable a feature of rural life in modern India.

SAM HIGGINBOTTOM.

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Distinguished Visitors

Their Excellencies Sir Harry and Lady Haig greatly honoured the Institute by a visit on January 13, 1937. Time did not permit them to see every department, but because of its relationship to rural development they concentrated on the

dairy and the cattle improvement programme. They saw the butter-making from pasteurized cream from the villages. They saw the cattle and the scientific feeding of them. They then visited the two milking stations, one at Indalpur where there are over fifty village buffaloes and cows. The buffaloes and cows are milked and fed under Institute supervision. The milk is brought into the Institute and pasteurized and separated. The cream is made into butter and ghee, the skimmed milk is fed chiefly to the calves.

The second milking station is at Ganeshganj. Here nearly a hundred village buffaloes and cows are brought in by their owners. There is a cream separator in this village. The milk is separated at the station. The villagers have been taught to use the separated milk, and also to feed their calves on it. Because separated milk is so cheap there and partly to show how the villagers can do it, a number of Institute buffaloe calves and heifer calves have been sent out to be fed on separated milk. The cream also is brought to the Institute pasteurized and made into butter and ghee. Since the Institute has been able to secure this village cream the quality of the butter has greatly improved. When we were getting cream from contractors there were very undesirable odours in the cream but now these are entirely absent.

Most of these villagers have had only a limited and irregular market for their milk and cream heretofore. The people to whom they sold it seldom paid them either regularly or in full. The reason the villagers are so anxious to come to the Institute milking stations is that their milk is weighed in their presence, and an accurate record is kept. They get the full agreed price for what they have to sell. In the Ganeshganj station they are receiving about Rs. 1,000 a month. These milking stations seem to have great possiblities for improving the financial condition of the villagers, in that it brings them a fair price for their dairy products. It should be helpful to the city because with proper supervision and sanitary production of the milk, the city should be able to receive

large amounts of dairy products of good quality at a cheaper rate than they can be produced within the city limits.

The Governor and Lady Haig were greatly interested in this development as it looks to be the sort of progress that can be made with very little expense of public money. It can be very largely self-supporting and should be entirely so after better quality cattle, that is buffaloes and cows, giving larger amounts of milk, can be introduced into the villages. The Institute is doing this through the provision of all the good Scindi bulls that are produced in the Institute itself, and also distributing some excellent animals provided by the Government department. The villagers themselves are keen on securing these better sires. I have seen nothing in connection with rural development that seems more full of promise than this.

Sir John and Lady Russell also honoured the Institute by a visit on Saturday, the 16th January, 1937. Sir John Russell is the agricultural expert brought out from Britain. While in Allahabad Sir John gave a very stimulating address to the Academy of Sciences. It was a pleasure to take him round the Institute. He seemed interested in everything he saw. The various members of the staff explained to him the particular thing that each was doing. We trust that the visit of Sir John Russell will mean a great advance to Indian agriculture.

"You are meeting to consider how the zamindars can help forward the great movement of rural development that has been initiated in this province We started the movement about a year ago and 207 rural development circles have now been established."

"I do not want landlords to act without conviction, I do not want them to do things merely because I importune them; but I want them to believe in the movement. Just as, if the movement is to succeed, we must have the genuine interest of the villagers, so I am sure we must have the genuine interest of the great body of landlords."

—*From an address by His Excellency Sir Harry Haig.*

MORE AND BETTER MILK

BY DR. SAM HIGGINBOTTOM

Talk broadcast from Delhi, Jan. 20, 1937

India contains more than one quarter of the world's cattle, though she has only about one-sixth of the world's human population. This means that she has many more cattle in proportion to her area and population than any other equal area of the earth's surface.

India has far too many cattle for the cattle work, draught and milk production, that has to be done; or for the food supplies available for cattle. But because of the poor quality of the cows, milk in India is scarce and dear. These surplus cattle are the most serious competitors of man for the produce of the soil. I endorse a policy of birth control for cattle.

The cow is a domesticated animal. That is, it has been taken from a state of wildness, and taken into partnership with man. Because cattle are domesticated man can control their breeding and he must control, if better cattle are to be. There is one sure way to imporve the quality of Indian cattle: that is to breed only from the best. If poor cattle are mated the offspring is poor. If good cattle are mated good offspring is likely to result.

India is dependent upon her cattle for: (*a*) power and (*b*) milk. The ox provides almost all the power for tilling India's cultivated acres. The power of an ox depends upon size and weight, the bigger and heavier he is the greater his power. Bigger and heavier oxen would enable large farm implements to be used with better cultivation and larger yields. Heavier oxen depend upon the breed, the feed, the geographical location. India has several breeds of good draught animals. These can maintain their size only if they are properly fed. Inadequate feed will stunt the growth of the best breeds. Again certain tracts of India seem to have certain nutritional deficien-

cies in the crops grown, so that cattle fed on these crops fail to grow to the size and weight they would were they brought up in an area where these deficiencies do not exist. India has done little to develop cattle with large milk-giving capacity. India values a good draught bullock higher than she values a good dairy cow. A really first class dairy cow can produce much more profit than a first class bullock.

The importance to India of good milk cows is almost impossible to exaggerate. Milk is probably the largest source of farming income in the world. The appalling death rate among the children in India just about the time of weaning is due largely to the fact that a supply of good, cheap milk is not available.

Few countries on earth are more favourably situated for good dairy cattle than India. There is an abundance and variety of fodder crops as Napier grass, which under proper conditions gives over 100 tons of green succulent fodder per year per acre; Guinea grass which will give 60 to 70 tons per acre. These home-grown cattle foods, if fed to a reasonable number of good quality cattle, would mean that the cattle could be in the finest condition: the oxen for work and the cows for milk.

The ability of a cow to give a large amount of milk of good quality is an inherited character. No amount of feeding, no quality of food will enable a cow to give more milk than her inherited capacity permits her to give. If a cow has an inherited character to give 3 seers a day, no amount of feeding or quality of food will cause her to give more.

The *gwala* usually explains that the poor quality of the milk of his cow is because he is too poor to give the cow good nutritious food. The quality of the milk is little affected by the quality of the food.

The poorness of the milk may be due to one of three things: First, the cow may belong to a breed of which the average butter-fat content is low. The great dairy breeds vary much in the percentage of butter-fat. The cow cannot change the quality of her milk; nor can feed change the quality of the milk except within very narrow

limits. The quality of the milk of the individual cow being an inherited character is as unchangeable by human effort as is the length of her tail or the colour of her hair. Granted that a cow has the capacity to give a large amount of good rich milk, if that cow is underfed, or fed poor feed, the quality of the milk will not change, but the amount of milk will be less than if she were properly fed. In dairying, two things are counted to be unwise: First, trying to increase the milk yield of a cow by better and larger feeding when that cow has not inherited the capacity to give more milk; and second to underfeed a cow that has inherited the capacity to give a large amount of milk, so that she gives less milk than she would if properly fed.

The second cause of poor milk in India is due to the custom of the *gwalas* taking the cows round to their customers, and milking for each customer just the amount of milk the customer desires. The first milk drawn from the cows is not as rich in butter-fat as the milk drawn towards the end of the milking. To get milk of an even quality the cow should be completely milked at one time, because the richest milk comes at the end of the milking. It is quite possible for a cow that properly milked gives milk of good quality, say 4 to 5% butter-fat, to have a customer get milk from that cow with not more than 3% of butter-fat in it, because the customer has received milk from the early part of the milking.

The third reason for poor milk is adulteration. If the water used for adulterating milk were always clean it would not be as objectionable as it is when contaminated water is used to adulterate the milk. Many deaths, infantile diarrhœa, dysentry, typhoid and choleric attacks are due to the adulteration of milk with contaminated water. Public opinion in India needs arousing to bring home to the *gwala* the terrible consequences of adulterated milk and the public needs to be willing to pay a fair price for good sanitary milk.

The only way to secure an abundant supply of good pure milk at a reasonable price in India is to breed cows

so as to increase their milking capacity and along with that to improve the quality of the milk. The skilful breeder will carefully weigh every milking, and thus know definitely how much milk a cow gives. Again he will test the milk for its butter-fat. He will then eliminate from his herd cows that give either a small amount of milk or milk of low fat content. The cows remaining in his herd will then be those that give larger amounts of milk of good quality. By breeding from such cows, noticeable improvement will take place.

It is a common saying among dairymen that the bull is 75 per cent. of the herd. The reason for this is that a cow can have only one offspring a year, whereas a herd sire may have from 60 to 100 offsprings during one year. The bull transmits the milk giving character from his mother to his daughter. Bulls with this capacity are to be found among the offspring of the best cows. It is fairly easy to tell a good cow from a bad cow, because the amount of milk and the quality of the milk can be measured, but it is impossible either by studying the pedigree or looking at the bull, to tell whether he will be good or bad. The only way to be sure of a good dairy bull, is to prove each bull: that is to mate the young bull to a limited number of cows whose yields are known, and then wait until the daughters of this mating come into milk. If the daughters give less milk than their dams the chances are that the bull is a poor bull. But if the daughters give more milk than their dams, it is reasonable to suppose that the bull has the power to transmit milk-giving capacity. Little progress will be made in India until dairy herd sires have been proven. Once you have a proven sire then progress is possible and may be rapid.

The importance of the sire has seldom been fully understood, that is why so little progress has been made. Most of the bulls wandering at large are unfit for dairy herd sires. They cause great loss. It is following the policy of using proven bulls that has brought the great dairy breeds to their present high standard, so that

to-day we have individual cows that have given over 20,000 lbs. of milk in less than than 350 days with one thousand pounds of butter-fat, while some have given well over 30,000 lbs. of milk. Several large herds average 10,000 lbs. per cow per year. The indigenous breeds of India in the hands of skilful breeders, given from 25 to 50 years, might approach the dairy breeds of the West. The sooner a breeding programme is undertaken in India on a large scale, the sooner better cattle will be available. It is not guess work. It is not haphazard. It is not wise to trust to luck. A definite programme in the hands of skilful trained breeders is sure of success.

While the building up of Indian breeds to profitable dairy production is possible, it holds out little immediate hope of an abundant supply of cheap milk. The shortest way to this is to import proven sires of the best dairy breeds and mate them with Indian cows. Where this has been done Indian cows giving from one to three thousand pounds of milk in 350 days, mated to the imported bulls have produced daughters actually giving from four to twelve thousand lbs. of milk in the same number of days. The offspring of the foreign bull and the Indian cow, while it may not in all respects be able to withstand conditions as well as the purely Indian cow is yet good enough to live and produce large amounts of milk and make a good profit for her owner.

Every cow must have a certain amount of food to maintain her body at a proper weight. If she does not get food enough for this she cannot give the amount of milk her inheritance calls for or bear a strong healthy calf. Any two cows of equal weight will need approximately the same amount of food to maintain their body in a healthy condition. But one of the two cows may have inherited the capacity to give only 2 seers of milk a day. The other may have inherited the capacity to give 25 seers a day. The skilled dairyman gives to every cow enough food to maintain her body at its proper weight, and then feeds the cow in proportion to the amount of milk she gives. The 25 seer cow should receive five or six seers a day

more grain and concentrates than the cow giving two seers of milk a day. Profit is made from the grain that produces milk, not from the grain that maintains the cow's body.

If a dairyman needs to produce 200 seers of milk a day, it makes a great deal of difference to his profits whether his cows give large amounts, or small amounts of milk. If he has cows that average 20 seers of milk a day then he needs only ten cows to produce 200 seers per day. In the case of the two seer cow, 100 cows would be needed and an enormous amount of food must be fed to these cows to maintain the body weight of the cows. This cannot return any profit. More buildings and equipment are needed, more men will have to be employed to take care of 100 cows than are needed to take care of 20 or 10 cows. From a consideration of this fact we can say that low yielding cows produce expensive milk, and high yielding cows produce cheap milk. As soon as this fact is understood by the people of India we can expect great improvements in dairy cattle. Every intelligent dairy cattle breeder today is striving to increase the yield and the quality of the milk of each individual cow. There is much more profit in one cow giving ten thousand pounds of milk a year than in two cows giving five thousand pounds each of milk a year. Five cows each giving 2,000 lbs. of milk a year may enable the dairyman to make bare expenses, no profit and no loss, but ten cows giving 1,000 lbs. of milk a year would almost certainly involve the city dairyman in a very serious loss.

To sum up the way to have better cattle in India is to have intelligent breeding programmes properly carried out, with proper feeding and care of the cattle. To improve the milk capacity and the milk quality likewise demands an intelligent breeding programme. And then again to see, when cows have been bred with a capacity to give much milk, that they are properly fed and cared for. These are simple but sure roads to success, and there are no other ways by which India may secure better cattle and more and better milk.

STUDENT AGRICULTURAL TOUR

By Haik Saroyan

B. Sc. Student, Agricultural Institute

The guard gave the signal and the train began to move slowly out of the station. "At last, no more lessons for another three weeks at least" I turned to the professor beside me. A kindly laugh and all was silent again. That night we greeted the New Year in the train on our way to Nagpur, Bombay, Ahmedabad, Baroda, Indore, everywhere!

For the next three weeks we had a heavy programme. How many farms, dairies, experimental centres and research laboratories we visited I find it difficult to relate. Nevertheless it would be hard on my part if I did not make any efforts to bring to the readers of The Farmer some of the very interesting and highly educative places we visited.

The Rural Reconstruction centre at Kosamba was perhaps the first of its kind we had ever seen. Under the able supervision of Mr. Souri this place is doing splendid work for the village folk. To teach the farmers and villagers at large on practical lines how to carry on a more tolerable and satisfactory life—this in short seemed to be the aim and object of this institution.

A considerable amount of controversy is going on at present about the inadequacy of diet in this country. At Kosamba without much talking the growing of abundant vegetables primarily for the use of the family was ably demonstrated. In some cases the plots were ten feet square and yet two different vegetables were thriving splendidly in the same plot.

The poultry section was not inconspicuous. Within a comparatively short time the imported cocks and hens have brought about considerable change at the Reconstruction Centre. The village folk round about were enthusias-

tic about everything that was to their own interest. We were told that every day men arrived to get the larger and heavier eggs of the imported hens, all being utilised for laying. The confidence in the centre was so great that the villagers easily took to the suggestions put forward. What little constructive work we could see in the short time at our disposal showed very clearly the triumph of the Reconstruction Centre. Seasoning of wood preparation of flour, crushing of oil seeds—for oil and cake—and preparation of cement were other items we witnessed being carried out right in the village area. The village hospital with a two bed maternity ward and the school left nothing to be said by way of criticism.

Going round these places I was led to believe that this is the kind of constructive programme that is most needed for the masses in this country. The slogan 'Rural Reconstruction' is in the air throughout the length and breadth of India but the amount of solid work done is not encouraging. In this connection much can be learned from Kosamba. The need of a dairy section was very much felt and we were given to understand that this also would be provided in the near future.

Turning away from Kosamba the Bombay Haffkine Institute attracts our attention most. A very huge and modern building with its various departments—the majority of the inhabitants being snakes, rats, rabbits, and bacteria cultures of various sorts. This Institute has done much in the past twenty or twenty-five years in the field of research to rid the citizens of India, and indeed those of the world,—from the curse of snake bites. The preparation of serum from snake poisons is one of the many important activities in the Institute.

Naturally this work involves a great deal of risk, and when at the order of the doctor-in-charge a man caught hold of a cobra from the head we stood aghast. The doctor coolly invited the snake to thrust its fangs into the parchment covering a glass, and the venom—a clear slimy liquid—was emptied out. The working of

poisons of various kinds into powder or crystal ready for exportation would take too long to describe.

Research on human plague was in full swing as the number of rabbits, and rats kept for trial suggested. In this connection model buildings on a miniature scale were on demonstration to show the ideal methods of getting away with rats and mice. These animals are responsible for carrying fleas which in their turn are instrumental in bringing about human plague. It is natural therefore that the destruction of rats and mice leads to the elimination of the sickness.

So far as agriculture, in particular, was concerned the agronomy students were perhaps the luckiest on the tour as they could get most out of it. All along our tour we had innumerable opportunities to get acquainted with some of the important crops of Central and West India. Throughout Central India everything works up to cotton. The black cotton area favours nothing but cotton, this being the only paying crop on a large scale. This very fact suggests that much is being done to improve the varieties of cotton, as the sub-branches and experimental centres of the Central Cotton Committee at Bombay, Indore and Broach showed.

At I roach continued work had shown that Broach Desi 8 (B. D. 8) was the best in all respects as far as environmental factors in that part of India were concerned. Next to it Navsari Selection 9 (N S. 9) had proved to be most satisfactory. One interesting point brought to us was the failure to cross New World cotton with Old World cotton. As is evident the genetic factor responsible for this is the difference in the number of chromosomes in the two varieties of cotton. Further, attempts in this direction had proved futile for all the plants which were the result of cross-breeding became sterile.

The Indore Plant Breeding Institute may be considered to be the only one of its kind in India if we take into consideration the work done on cotton. Under the able direction of Mr. Hutchinson much has been done in the field of cotton research and prolonged

investigations have shown conclusively that Native 9 is the best cotton for that part of India.

Of late one of the workers in the plant institute after touring Iran for about four months had returned bringing with him some specimens of Iranian cotton. Iranian cotton challenges many of the best Indian varieties, and but for the relatively coarse and rather weak fibres it would stand at par with any good species.

Other major items of interest from the point of view of agronomy were the researches on sugarcane and cotton at Indore and Baroda, and the experiments on *juar* at more than one place. A cross between sugarcane and *juar* has been carried out at Coimbatore. At Indore they were trying to grow these crosses which if successful might prove to be a blessing in more than one way.

So far as horticulture was concerned Poona provided the best of things to be seen. The Agriculture College gardens were well laid out and among other things they had grapes, guava, banana, papaya, mango, grape fruit and lemon in plenty. Later we learned at the Ganeshkhind Gardens that figs do not do well in that part of India.

The outstanding feature of the College gardens was the guava trellis which was provided with a strong and quite high fence. The trees were planted about fifteen feet apart. When the first branches appeared they were extended both ways to meet those of the neighbouring trees. This process was continued as fresh branches appeared at more or less regular intervals so that in course of time a really beautiful fence was realised with no decrease in the yield of fruit.

Throughout the Bombay Presidency the lime is grown in plenty. The Italian lemons at the Ganeshkhind Gardens gave evidence of all success. Harvesting of limes is done in the rainy season, and as there is little demand for them at that time many of the limes are utilised in preparing lime juice as was shown at the College gardens.

The Ganeshkhind Garden was the most interesting horticultural centre on the tour. Originally a botanical garden it can now claim to be one of the best if not the best fruit growing centre in West India. They had grapes, Italian lemons, and many other fruits in plenty.

The chief work here may be considered to be the experiments being carried out for preserving fruits in cold storage.

We were taken round different chambers the temperature ranging from 32°F to 68°F.

The following table is self-explanatory and needs no further comment.

Table to show the effect of temperature on the preservation of fruits.

Temp. in Storage	Effect noticed on Fruits
32° F.	Apples keep well for more than four months.
35° F.	*Desi* potato keeps well and does not sprout even after 10 months. Apples and oranges keep well for four months, but they shrink a little.
40° F.	Hill potato keeps more than a year. *Desi* potato sprouts at 9 months. Oranges kept for 3 months were perfectly normal. Pomegranates shrink after 4 months.
45° F.	Grapes keep well for 6 months Mangoes and oranges also keep well.
52° F.	Oranges obtain beautiful colour at this temperature, and keep well the year round.
56° F.	Bananas kept for 2 months showed 10 % loss.
68° F.	At this temperature sprouting of potatoes is activated.

In the same gardens experiments on irrigation have shown that the furrow system is better than the ring system. They claimed that the furrow system of irriga-

tion improves the physical condition of the soil and thus work with bullock power becomes easier.

* * * *

If I were asked a month ago to express my opinion regarding the dairy industry and livestock in India, I would have said "not encouraging." Now I have to admit that that view of mine does not hold true. The Sindi cows and Murrah and Surti buffaloes at Jubbulpore Military Dairy and Poona Agriculture College, the graceful Ghir cattle at Kandivilli Farm in the Bombay Presidency, and last but not least of all the Kankrej cattle at Northcote Breeding Farm, Cherodi, have all had an important bearing in changing my ideas. Mention should be made that the above list is not complete in so far as the breeds of cattle in this country are concerned. A few words specially about the Kankrej cattle at Northcote Breeding Farm will not be out of place. This breed is not a particularly good milker, for the Sindi, the Ghir and the Sahiwal cows are far superior. Yet the advantage the Kankrej exercises over other breeds is its adaptability as as a dual-purpose animal.

Northcote Farm is about two and a half miles away from Cherodi Station, and the Kankrej bullocks drawing the carts in which we were seated could cover the whole distance in about twenty minutes. In emergency cases the same distance could be covered in about fifteen minutes. This part of the journey is a pleasant one with the bullocks trotting uniformly all the way back and forth. Not to create any prejudice about the milk yield of the cows I may add that the average has been greatly increased in the past thirty years, and individual animals may stand at par with a good Sindi or Ghir cow.

Covering an area of 2,200 acres provision is made at the farm to keep the animals on pasture the year round. For fodder they seem to have no difficulty as hay is plentiful and clover and *juar* they can grow in abundance. Strong and hardy, the Kankrej cattle are least

affected by diseases and epidemics, and are practically unaffected by inclemencies of the weather the year round. Indeed a more hardy animal could not have been sought to till the cotton fields of Central and West India, and at the same time provide for an adequate milk supply to the village folk.

The Telenkeri Dairy at Nagpur and the Polson's Cream Factory at Anand would be of special interest to tho readers of THE FARMER. Unfortunately it is impossible to go into any detail regarding the above concerns.

Before concluding I may add that what little I saw in the past three weeks was enough to convince me of the great scope open to the dairy industry in this country.

In the West dairying forms the backbone of more than one country and given a band of trained and experienced animal breeders and dairymen there is no reason why India should not stand with the West in this field. The chief point to note is that we have the material to work with in India. One man may take to the breeding and improvement of only Indian cattle. Another person may resort to cross-breeding. This need not worry the average man who has a genuine interest in dairy industry.

A difference in programme will not prove to be a cause of total failure provided our common goal is the improvement of livestock and the establishment of the dairy industry on a sound basis.

"It's good to have money and the things that money can buy, but it's good, too, to check up once in a while and make sure you haven't lost the things that money can't buy."—*George Horace Lorimer.*

PANCHAYT MANIFESTO

By Deva Datta Sharma

B. Sc. Student, Agricultural Institute

The structure of an old Indian village was based upon the doctrine of socialism governed by the laws of equality, co-operation, and self-help. Every village had its self-government named the Panchayt. The voice of the people was considered to be the voice of God and the Panchayt recognized this voice to be their leading force. Under the old Indian village, land belonged neither to the landlord nor to the government nor to the cultivator. It was the common property of the village. Land, like water and air, was a free gift of nature. There was co-labour (Bhayachara) in which the farmer was only responsible for tilling the soil. A carpenter, blacksmith, potter, weaver, washerman, *halwaha* all were servants of the village and not of any single individual. A learned man would teach the village children, girls and boys, but take no pay or fees. It was his share of the work of the village. Education was free. Everybody was alike interested in a good harvest. The cultivator would not take all produce for himself but divide it among the factors that produced it. Every individual in the village was entitled to a share in the village produce. Everybody's interest was in the common good and this was responsible for the village prosperity under the Panchayt system.

We still find the Panchayt and some of the co-operative principles conserved by the village society, but the co-labour system today is nothing but the 'Jajmani' system which recognises superior and inferior occupations. The co-operative system of the Panchayt is nothing but serfdom today. There is class and caste distinction. There is social and economic exploitation. How have these things come to be? How has the old regime of socialism, equality, and co-operation led to the poverty stricken ignorant masses being exploited by certain agencies which were unknown

in those days? The landlord and the money-lender have entered this self-governed village unit and have broken the bonds of co-ordination. Thus the Indian village stands with its complex problems and a conservative Panchayt structure which has undergone centuries of evolution and revolution.

Principle of Panchayt

Even today the villager has great faith in the Panchayts which exist in several villages and communities. Especially the low caste people have them working wonderfully. I know certain Panchayts in Western United Provinces which have framed certain social rules and have abided by them. They have reduced litigation. If they can do good work in that field, why should they not be successful in the field of economics which is of urgent importance to them as well as to the country? To make use of the faith and the confidence of the villager we should make the Panchayt an instrument of our rural uplift. Start from their level and go up and up and bring them up to our level and standard without letting them feel that you are a foreigner to their village customs. They need a little inspiration from outside. Then let them organise Panchayts and stand on their own feet without expectation of outside help and thus run their village on the principles of self-government and self-help.

Village organisations in other countries

If we look to the economic life built up in other countries of the world we find Panchaytlike organisations responsible for the better standard of living in the villages. It is the most practicable solution for the immediate rural problems of India. Most countries of the world like Russia, China, Japan, Ireland, New Zealand and America have achieved greatly through village co-operative societies managing the village in the economic fields. Co-operative marketing, co-operative cultivation, co-operative industries, co-operative banking and other

co-operative activities are bringing new life and prosperity to those countries. The co-operative movement in India has not been very successful because it has not taken into consideration the agent (Panchayt) and the village instincts through which it could be successful

In other countries each person is responsible for his part in the common activities of village life. In Japan municipalities do not provide lights in the towns because every house will have its own facing the road side. In Russia and some other countries the repair, the maintenance, and the cleaning of the roads is done by people who use the road. The great problem of the rural transportation due to bad *kachcha* roads will be solved if the villagers co-operate to level and clean the road leading to their village and provide good drainage and care for it.

To take an instance of the co-operative marketing of California fruits we find why it is that California fruit growers have captured the world's fruit market. Each village will have a co-operative organisation sending the fruits to the bigger organisation consisting of 10 villages. Fruits well packed and cared for are sent to the central organisation which controls the prices for the good of the California fruit growers. This central organisation knows how much the supply is, what is going to be the demand and accordingly does the marketing for the growers living far away from the main city. Many of the co-operative associations are running successfully in India, too, adding to the prosperity of those who know how to co-operate. The *gwala* co-operatives at Nagpur and Allahabad are some of the good examples. The Indian village, which was the pioneer of the co-operative system and is still to a certain extent in the form of family system and village Panchayts, should make use of the co-operative principles in order to raise its standard of living. Co-operative organisation is the only solution for village poverty within its complex social and economic structure. A village self-government will create new life and prosperity both for the village and for the nation.

Constitution of Village Panchayt

Representatives of all the activities in the village should constitute a village Panchyt. Thus there should be ministers of discipline, sanitation, marketing, production of agricultural goods, industry, finance and social organization according to the village needs. These ministers should be qualified for their work and entrusted with their responsibilities. Such a unit should command the support of the whole village and should represent it in the central Panchayt consisting of, say, 10 villages.

Aims: (1) To maintain a decent standard of living and to provide employment.

(2) To safeguard civic, economic and social rights.

(3) To act as village self-government on the principle of co-labour (Bhyachara).

Departmental Activities

1. *Marketing section*: To provide for village needs and to dispose of village agricultural and industrial produce. To create markets for village commodities.

2. *Industrial section*: To turn raw country products into finished products and to provide full time or part time work in the form of cottage industries and big industries.

3. *Agricultural section*: To run a co-operative dairy; to manage co-operative labour; and to produce field and horticultural products.

4. *Finance section*: (1) To collect money in the forms (a) subscriptions, (b) donations and (c) charges for different services like marketing. (2) To run a co-operative credit society (3) To keep full banking and other accounts.

5. *Social and Civic section*: To fight for social and civic rights and to arrange fairs, competitions, exhibitions and other functions.

6. *Education section*: To manage primary and technical education for girls, boys and adults. To operate a library and to give daily news to villagers,

(Continued on page 99)

WHEAT RUSTS

S. CHOWDHURY

The rusts are the most important diseases of wheat in India. They are the most widely known and most dreaded of all the diseases of wheat not only because of the economic loss actually produced but also because of the importance of wheat as an article of food. No other disease of the wheat plant can compare with the rusts with regard to the extent of damage done.

Economic Importance: The economic importance of wheat rusts can best be realised from the monetary estimates of loss brought about by them. The ravages of rust vary greatly from year to year and it is obvious that an accurate estimate of the annual loss is impossible. Further the damage done in the great wheat-growing tracts of North-Western India is generally slight, while in Bombay, the Central Povinces, Bihar and Bengal the crop may be reduced 50 per cent. or more. One of the first estimates of the damage done by rust was made by Barclay (1889) who calculated the loss at one per cent. or Rs. 40,00,000 on a crop of 6,510,797 tons raised from 26,508,000 acres and valued at Rs. 4,10,191,677. Indeed Barclay himself considered this estimate too low and suggested that the actual loss was likely to be five times as great. Watt (1895) estimated the annual loss at rather over than under 10 per cent. The acreage under wheat has since increased to about 34½ million acres and the average annual yield is estimated at 9¼ million tons., The loss due to rusts must also be proportionately high. Butler (1903), Butler and Hayman (1906) and Mehta (1929 ; 1931, have held the sum of Rs. 40,00,000 to be the minimum loss that India suffers annually due to rusts in wheat. It is thus evident that wheat rusts are of enough economic importance in India to justify an intensive study of their causes and the means of controlling them

The Three Rusts : Wheat in India suffers from all the three rusts known on that host.

1. Black Rust : *Puccinia graminis*, Pers.

2. Yellow Rust : *Puccinia glumarum*, Eriks. and Henn.

3. Orange Rust : *Puccinia triticina*, Eriks.

"*Puccinia graminis*, Pers. usually does not appear on the wheat until late in the season. It is often not seen until March in Northern India, a time when the wheat is in ear. Its onset is first marked by an eruption of elongated, brown pustules on the stalk, leaf-sheaths and leaves, the stalks being often most attacked.

"*Puccinia glumarum*, Eriks. and Henn. is usually of earlier appearance than *Puccinia graminis*, coming out as a rule before the grain is formed. In mild attacks the uredo-pustules are formed chiefly on the leaves, but in more severe cases, they appear on the sheaths, stalks and glumes as well.

"*Puccinia triticia*, Eriks, is the earliest rust to appear. Sometimes it is noticed in the later part of December but usually it appears in the beginning of January. The uredo-pustules come out on the leaves as a rule being scarce on the sheaths and stalks." (Butler *Fungi and Disease in Plants.*)

Distribution of the Rusts : Although the rusts are for the most part practically co-extensive with wheat cultivation they are not serious in all the localities. Epidemics may occur in almost any wheat-growing area, but they occur less frequently in some areas than in others. In general, the area most affected is the Indo-Gangetic plain where the yellow rust and to a lesser extent the orange rust are of common occurrence. Late in the season the black rust also appears but relatively it is not so important as the other two. In the Central India tracts and the Deccan black rust seems to be relatively more important—the other two causing minor damage.

LIFE HISTORY OF THE RUSTS

The rusts belong to a group of parasitic fungi, the Uredineae, which are remarkable for possessing, when perfectly developed, four distinct stages in their life history. These are characterised by four distinct forms, which though belonging to the one plant, are often separated from one another by an interval of time and sometimes require more than one host plant for their successive development.

To understand fully the problem presented by the disease, it is necessary to distinguish between these four stages:

(*i*) *Uredo Stage*: The first stage in the life history of any one of the wheat rusts may be taken as marked by the appearance of rust pustules on the growing wheat in Northern India in January. When a wheat plant showing the first evidences of rusting is examined, it is found to be marked here and there by round, oval or elongated, raised patches of a reddish colour known as sori. These contain thousands of single-celled, double-walled, spiny, light, yellow or orange-coloured spores called uredo spores. On the rupture of the epidermis the uredo spores are set free and carried away by wind to healthy plants, which are infected. The disease thus assumes an epidemic form.

(*ii*) *Teleuto Stage*: This stage is characterised by the production of a second class of spores called teleuto-spores in the uredo-sori late in the season. The teleuto-spores are resting spores and thick-walked, dark-brown in colour. Having accomplished a period of rest they germinate in the presence of moisture putting forth a basidium.

(*iii*) *Basidial Stage*: This is the third stage. As soon as the basidium ceases to grow, it

divides into segments, from each of which a minute stalk grows out laterally. On this a small ovoid spore is formed. These spores are called sporidia. They are colourless, loosely attached to the stalk and while falling off they are disseminated by the wind.

(*iv*) *Aecidial Stage*: This stage that results from the the germination of sporidia requires in the case of the rusts under study a new host termed 'the alternate host.' But in some cases the alternate host is yet unknown and is perhaps non-existent. The connection between the acidia on the barberry and the black rust on wheat has long been known due to the researches of Plowright (1882), Freeman and Johnson (1911), Lind (1913), Gussow (1913), Stakman and Piemeisel (1917), Broadbent (1921) and others and will be described here.

The sporidia are incapable of infecting wheat plants but they can attack the barberry (*Berberis vulgaris* L.) in the case of the black rust. Here usually two spore forms are produced by the stem rust—the *Spermogonia* and the *Aecidia*.

Spermogonia: After the infection of the barberry leaf by a sporidium from the teleuto-spore of black rust of wheat flask-shaped bodies called *Spermogonia* appear on the upper surface of the leaf. Within the spermogonia spores called spermatia are formed. Until recently these were considered functionless. But recently Craigie (1927, 1931) has shown that certain rusts are heterothallic, that is both plus and minus mycelia are produced by the germination of sporidia. Monosporidial infections in such cases produce spermogonia but no aecidia are formed. If, however, spermatia from spermogonia developed on a plus mycelium are mixed with the nectar from a minus spermogonium or *vice versa* aecidia soon appear.

Aecidia: A few days after the first appearance of the spermogonia, a second form of receptacle of a golden yellow colour, the well-known "cluster-cups" appears. They are the aecidia within which aecidiospores are formed. These spores are almost exactly like the uredospores except that they are of a more golden yellow colour and often angular. They are disseminated by the wind and germinate on falling into water by putting a germ filament, which as De Bary (1865) discovered can carry the fungus back to the tissues of the wheat plant but not to the barberry.

Propagation of Rust from Season to Season

Were this cycle to be repeated invariably, it is evident that the presence of an alternate host in the vicinity of wheat-fields would be absolutely necessary for the recurrence of the disease. In the plains of India, especially in the tracts where black rust is common, barberry does not occur. Barberry bushes (*Berberis vulgaris*, *B. aristata*, *B. lycium*, *B. umbellata*, *B. coriaria*) occur only in the hills at elevations over four to five thousand feet. Besides the experiments of Butler and Hayman (1906) and Mehta (1929, 1931, 1934) have shown that sporidia from wheat black rust teleutospores are incapable of infecting the barberry found in India and producing the aecidial stage. The same investigators have also proved that aecidiospores from aecidia found on the species of barberry in India are not capable of attacking wheat when artificially inoculated.

The case of the other two rusts of wheat is quite parallel to that of the black rust. The alternate host of *Puccinia glumarum* is as yet unknown and is perhaps non-existent. In the case of *Puccinia triticina*, Jackson and Mains (1921) in America and Ducomet (1925) and Sceibe (1930) in Europe have succeeded in producing aecidia on species of *Thalictrum* by artificial inoculations with the teleutospores of the fungus. Shitikova Roussa Kova (1927) reports to have found aecidia of *P. triticina* on species of

Thalictrum, while Alabouvette and Meneret (1927) by sowing aecidiospores from aecidia on species of *Thalictrum* on varieties of *Triticum vulgare* found uredo-sori agreeing with those of *P. triticina* on three occasions, 11 or 12 days after inoculation. On the other hand, when Eremeyeva (1924) inoculated three species of *Thalictrum* (*T. minus*, *T. simplex* and T. *aquilegifolium*) with teleutospores of *P. triticina*, spermogonia appeared after 13 or 14 days but no aecidia were found.

Barclay (1887) found aecidia on *Thalictrum minus* on Tibet road. Mehta (1931) has also observed aecidia on *Thalictrum* in Kumaon and Simla Hills. But because of the fact that teleuto-stage of *P. triticina* is very scarce and often impossible to obtain in India and all germination tests with the teleutospores have been unsuccessful as yet, Mehta (1934) doubts very much the existence of an alternate host of *P. triticina* in India.

It has long been known that in the propagation of rusts the aecidial stage can be dispensed with. Black rust is prevalent in Australia where wild barberry is unknown and cultivated examples are not common (McAlpine, 1906). Orange rust is found to attack wheat every year in England where the aecidial stage on *Thalictrum* has been found connected with *Puccinia persistens* on *Agropyron repens* (Grove, 1913; Mehta, 1923). Yellow rust occurs in all the wheat-growing countries, though the question of an alternate host is a mystery in its case. How then are these rusts propagated from season to season? Butler and Hayman (1906) and Mehta (1929) have shown that the uredospores of all the three rusts are short-lived and cannot survive in the hot and dry conditions of the Indian summer in the plains. Teleutospores have been found incapable of attacking wheat directly (Mehta, 1923). The possiblity of infection being carried from year to year by means of seed (Prichard, 1911) has been studied by Hungerford (1920) and Mehta (1923); both of them have obtained negative results. The "Mycoplasm Theory" of Eriksson (1897) has been incapable of explaining the propagation of the

rusts from season to season (Ward, 1905; Aderhold and Ruhland, 1907; Bolly, 1906; Butler and Hayman, 1906; Mehta, 1923).

Investigations carried out by Mehta for the past ten years or more have succeeded in indicating solution of the mystery. Wheat is a winter crop in she plains of India but in the hills the cultvation of wheat extends to a much later period due to low temperature. There are also self-sown wheat plants in the hills, on which all the three rusts have been found. In October and in early November wheat is sown on the plains and the uredospore are blown from the rusted wheat in the hills to the plains. By an ingenious system of exposing slides near wheat fields in different tracts Mehta (1929) has followed the march of rust incidence. It is now known that the three rusts of wheat in the plains are due to their uredospores surviving on sown and self-sown wheat in the hills.

It has been suggested that even though the uredospores are short lived and cannot stand the intense heat of summer they may live in the soil where conditions are different and where their life-histories have not been followed (Desai, 1935). But it is doubtful whether uredospores which are very sensitive to temperature can at all survive in the soil where the temperature is always higher and the percentage of carbon dioxide more than that of the air. Moreover, even if the uredospores are capable of living in a viable state in the soil why do they not infect the wheat plant soon after its germination when temperature and humidity conditions for infection are favourable ?

The Influence of Weather on Rust

Rusts do not appear in uniform abundance year after year, the incidence depending upon the weather conditions to a great extent. Observations made all over the world show that periods of excessive rainfall followed by warm muggy days favour the development of the disease. The cultivators in India also hold the same view.

Barclay (1892) endeavoured to trace a relation between the price of wheat and the factors which favour rust in January, February and March. Cloud, humidity and rain in these months were found favourable for the development of the disease. Moreland (1906) made similar observations in the United Provinces and found that the rust varies generally with the humidity of the months of January and February taken together. Similar observations were made at Pusa during the wheat seasons of 1906 and 1908. Too moist or too dry a seed-bed, long-continued wet or cloudy weather during any period of the growth of the crop were found to favour the development of rust.

Means of Controlling Rusts

While a study of the origin, development and spread of the disease is of scientific interest, the grower is primarily interested only in the possibility of eradicating or controlling it. The variety and extent of the disease coupled with its reaction to weather conditions invest the question of control with peculiar difficulties. The suggestions so far made in this direction can be grouped under the following heads:

(1) Cultural methods.

(2) Fungicides.

(3) Eliminating the inoculum.

(4) Selection and breeding of resistant varieties.

(5) Selection and growing of early varieties.

(1) *Cultural Methods.*—Experiments on the influence of different cultural methods—irrigation, drainage, weeding, cultivation, depth of sowing, manuring—have been done all over the world by numerous investigators to determine the effect of each of these farm operations on the development of rust. None of these common cultural methods except that of manuring have been found to be of any importance. Petterman (1902), Schulz (1927), Mencacci (1928), Wachs (1928), Gassner and Hassebrauk

(1934) after numerous experiments state that nitrogenous manures promote the incidence of rust while potash and phosphatic manures suppress it. This view has also been recently supported by the experiments of Bouriquet (1934) and Grosshevoy and Maklakova (1934). It may be generally stated that in rich nitrogenous soil rust attacks will, as a rule, be severe on account of increased succulence of the plants, increased rankness of growth, delay in drying out after showers and dews and the comparative delay in ripening. On the other hand potash and phosphatic fertilizers shorten the ripening period and thus act as rust preventive. In Madagascar (Bouriquet, 1934) and Russia (Grosshevoy and Maklakova, 1934) cultural methods have been found to be the most promising in the control of rusts. The practical farmer should not lose sight of these facts.

(2) *Fungicides.*— As the source of infection i.e., the uredospores, are borne by wind a protective layer of a fungicide on the leaf surface before the infection has already taken place would surely help to control the disease. Numerous experiments in spraying and dusting fungicides (details of which cannot be given here for lack of space) have been made all over the world for rust prevention and have been found sufficiently effective. The most extensive experiments have been carried out in Canada, where motor trucks and aeroplanes with suitable dusting equipments have been utilised in dusting wheat fields with sulphur. By dusting wheat with sulphur Neil (1931) has obtained an increase in yields in the dusted plots ranging from 17 to 96 per cent. over the undusted. Petit (1932) reports a complete control of yellow rust by dusting with non-decyanurized precipitated sulphur, precipitated sulphur codex and a mixture of 88 per cent. gypsum or lime with one per cent. paraformaldehyde and one per cent. cyanamide. Broadfoot (1931) obtained similar results, while Greaney (1934) reports that by dusting wheat with sulphur not only an increase in yield upto 400 per cent. is obtained over the undusted but the quality of the grain is improved from "feed"

weighing 40 lbs. to "1 northern" weighing 60 lbs. per bushel. Sulphur dustings have also been found useful for controlling wheat rusts by Gassner and Straib (1930), Lehman and Poole (1929), Mains (1930), Gassow (1928), Lambert and Stakman (1926, 1929), Baily and Greaney (1925), 1927, 1928), Greaney (1928, 193 , 1934a). But all these experiments have shown that any kind of spraying to be effective against the rusts should be applied in great amounts and at short intervals. Unfortunately none of the investigators have stated the cost of spraying fungicides and the benefits achieved therefrom in terms of money—a fact of paramount importance from the economic point of view. Only recently Silibia (1934) has reported a net profit of 20 lire per hectare due to dusting with sulphur—roughly a net profit of Rs. 6 per acre.

In India, however, no effort has yet been made to combat rusts by fungicides. Whether the method will be practicable and economical in the peculiar conditions of India cannot be said till experiments have been made. The method may very well be tried in the Governnent experimental farms, and if found successful it may be demonstrated to the cultivators in the neighbourhood of experimental and demonstration farms. The Co-operative Department might undertake the distribution of chemicals and appliances on a cash or credit basis.

(3) *Eliminating the Inoculum.*—In Denmark (Lind, 1915), In some parts of North America (Stakman, 1923) and in Norway (Henning, 1916) where the barberry was found responsible for the annual recurrence of black rust of wheat, its eradication has made the occurrence of black rust a thing of the past. In India where the cultivated and the self-sown wheat in the hills—the Himalayas, the Nilgiris and the Western Ghats—furnish the inoculum it appears possible to put a stop to the severe outbreaks of rust by the suspension of wheat cultivation for sometime and by a systematic eradication of the self-sown wheat in the hills. But such a procedure is not without practical difficulties. Because wheat is a food crop the cultivator will be reluctant to suspend its cultivation for any appreci-

able length of time and even if coercive measures be sanctioned by the legislature there are the native States where compulsory legislation is out of the question. Under the circumstances the growing of resistant varieties would solve the problem to a great extent.

(4) *Selection and Breeding of Resistant Varieties.*— The final solution of the problem of wheat rust in India lies in the selection and breeding of resistant varieties. This is how the disease has been held in check in other countries.

That there are varieties of wheat that resist rust has been known from the middle of the last century. It is stated that when wheat epidemics became very severe in the United States of America an expedition was sent to South Eastern Russia in 1896 to fetch resistant varieties because wheat brought from those parts by emigrants had resisted attacks. As a result of extensive investigations in both the hemispheres it is now known that there are several wheat varieties which have a certain degree of resistance to one or the other rusts attacking wheat.

In India Pusa wheats, P4 and P52 have shown such resistance. A ray or hope having thus been discovered, the efforts of the scientists at Pusa, Cawnpore, Lyallpur and Poona have now been directed to find suitable rust resistant varieties. A variety may not resist all the three rusts but since all the three kinds of rust are not usually found in one place the discovery of even a variety resisting only one kind would be a great achievement,

Difficulties in Breeding Rust-resistant Varieties.— Biffen (1907) and others have demonstrated that resistance and susceptibility of cereals to rusts are Mendelian characters and inherited in Mendelian proportions. But on account of the presence of "physiologic forms" of wheat rusts, the susceptibility of wheat to other diseases of considerable economic importance and the need for conserving other desirable characters like "high yield", "better quality of grain and straw", "good standing power", "early maturity" which are always looked for—the pro-

blem of breeding resistant varieties is a slow process fraught with many difficulties:

(*i*) *Physiologic Forms.*—It is very often noticed that power of resistance is not maintained when wheats are moved from one climate to another. Several Australian wheats believed to be resistant have failed when tried in India. On the other hand "Kathia" which is very liable to all the three rusts at Cawnpore, was found by Carleton (1899) worth recommending for trial as a resistant sort to *Puccinia triticina* in America. Even within the boundaries of India resistance in one locality does not mean resistance in another. Thus spelt wheat which in Bombay and at Hissar is highly resistant was stated to be rusted very badly at Nagpur in 1903. This behaviour of wheat varieties resistant in one locality and susceptible at another or resistant in one season and susceptible in another in the same locality has been found due to the existence of "physiologic forms" of rusts (Stakman, 1914; Stakman and Piemeisel, 1917).

In India, however, the number of "physiologic forms" of the three rusts is probably not large. As yet only four forms of black rust, two of yellow and two of orange have been found (Mehta, 1934). This has made the breeding of rust-resistant varieties comparatively easier in India than in North America where black rust alone has been known to have more than 130 "physiologic forms." Moreover Aamodt (1923, 1934) has discussed the possibility of breeding resistant varieties of wheat in the presence of many physiologic forms; he has found that often resistance to more than one physiologic form is controlled by a single factor, thus immunity

to 11 physiologic forms of black rust in Kanred wheat is governed by a single genetic factor. Goulden, Neatby and Welsh (1928) found that the factors which controlled reaction to physiologic form XXI were also responsible for reaction to forms IX, XIV, XV, XVII, and XXXIV. This mode of inheritance makes breeding against rust relatively easier. But there are varieties which possess resistance-inhabiting factors (Goulden and Neatby, 1931) ; and what is worse a factor for resistance to a particular form may bring about susceptibility to another form (Goulden, Neatby and Welsh, 1928).

(*ii*) *Susceptibility of wheat to other diseases.*— Perusal of literature reveals that some of the very desirable rust-resistant wheats are susceptible to other diseases like flag-smut, loose-smut, bunts, Helminthosporium root-rots and leaf-blights. The work of the plant-breeder has thus been much wasted because the damage done to the crop by smuts, bunts, or root-rots are no less than those caused by rusts.

Bunts for instance, exists in a severe form in India. Flag smut and loose smut are not diseases to be let alone. Helminthosporium leaf-blights are also very bad and root-rot of wheat-seedlings takes an enormous toll in certain parts. For the plant-breeder in India engaged in breeding rust-resistant varieties it is not enough, therefore, to breed for hybrid strains of wheat highly resistant or immune to rusts but he must endeavour to combine in such hybrid strains a fixed resistance to bunt, loose-smut, root-rot and many other diseases to which wheat in this country is susceptible.

(*iii*) *Other desirable chaacters*: The fact that in breeding rust-resistant varieties the plant-breeder should also try to improve the quality of the grain and the straw, increase the yield of grain per acre, improve the tillering habit of the plants makes the task even more complex.

But the importance of the problem to our agriculture demands that every effort should be made to realise the objective as expeditiously and as completely as possible. Under the auspices of the Imperial Council of Agricultural Research the breeding of rust-resistant varieties has been undertaken at Pusa and Simla. As none of the indigenous varieties of wheat so far tested have been found resistant to all the physiologic forms occurring in India and as the few resistant exotic varieties seem to be unsuited for direct cultivation under Indian conditions, it has been proposed and planned that in breeding rust-resistant varieties the best indigenous varieties will be crossed with resistant foreign ones with the object of combining both the agriculturally and economically desirable qnalities of the former with the rust-resistance property of the latter (Pal, 1935).

(5) *Early Variety.* Hand in hand with the selection and breeding of rust-resistant varieties efforts should also be made to select "early" varieties. Brega (1927), Savulescu (1933) and Steiner (1934) report that by sowing wheats earlier the rust attack can be minimised considerably, while Dodoff (1933) sowing wheat on 25th September, 1931 obtained a yield of 1925 k.g. as compared with 590 k.g. from the same quantity sown on November 9, 1931. It appears that if wheat could be sown in the latter part of August or beginning of September and the crop reaped by the last week of December or first week of January, a large part of the loss due to the rusts might be avoided successfully.

Conclusion

From the foregoing paragraphs it will appear that though important data have been collected and valuable results obtained, still the problem of wheat rusts is not yet conquered. Nature is always jealous in guarding her secrets, and every important discovery is built upon long years—even decades and centuries—of human toil and sacrifice. Hence there is no reason to despair of ultimate success. Maybe it will not be possible to eradicate wheat rusts once for all. But it should not be impossible to discover methods by which the disease can easily be kept under control through constant effort. Eternal vigilance is the price which mankind has to pay for its civilisation.

Summary

(1) The minimum loss India suffers annually due of rust in wheat has been estimated at over Rs. 40,00,000.

(2) Wheat in India suffers from three kinds of rusts—black rust (*Puccinia graminis*, Pers.), yellow rust (*Puccinia glumarum*, Eriks and Henn.) and orange rust (*Puccinia triticina*, Ericks.)

(3) The part worst affected is the Indo-Gangetic plain where yellow and orange rusts are very common and black rust also appears late in the season. In the Central India tracts and the Deccan black rust is more important.

(4) Comprehensive study has revealed that the three rusts have only two stages in their life-history—the uredo and the teleuto. No alternate hosts have been found in the plains or in the hills.

(5) The data obtained so far clearly indicate that the three rusts are propagated by their uredospores and the foci of infection in the case of all the three rusts lie in the hills.

(6) Observations made so far show that periods of excessive rainfall followed by warm muggy days favour the development and spread of the disease.

(7) The data obtained so far show that the ravages of the three rusts can be controlled by better methods of cultivation, use of fungicides and by growing resistant varieties. But it seems that the most effective solution of the problem of wheat rusts lies in the production of disease-resistant varieties.

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PANCHAYT MANIFESTO

(Continued from page 81)

7. *Health and sanitation*: To provide medical aid and sanitary arrangements and education in the village.

Each section to have at least one man paid or honorary who will be responsible to the village to run the machinery of Panchayt successfully. Each village unit will have one general secretary. These secretaries will represent their respective villages in the central Panchayt which will govern the village activities in general relations between different units without interfering in the least with the freedom of the village units.

Book Review

WISER, WILLIAM H., THE HINDU JAJMANI SYSTEM, PP. 192, THE LUCKNOW PUBLISHING HOUSE, LUCKNOW, U. P., INDIA, 1936.

The Hindu Jajmani System is a monographic report of an intensive case study of one of the many facts of the caste system as found in a village in North India to which the author, Dr. William H. Wiser, has given the pseudonym of "Karimpur." The original report of this particular study served as a thesis by the author in partial fulfilment of the requirements for the Master's degree at Cornell University in 1932. We should note that Karimpur is the same village that was the subject of Dr. and Mrs. Wiser's book, *Behind Mud Walls*, published by Richard R Smith, Inc. 1930, and also of a subsequent study entitled, "The Social Institutions of a Hindu village in North India," which was presented by Dr. Wiser at Cornell University in 1933 as a thesis in partial fulfilment of the requirements for the Doctor's degree, and as yet unpublished. These three intensive socio-cultural studies of the same village indicate something of the almost limitless source of material for investigations of this sort presented by the average Indian village, and by implication, they also point to the need for a full and sympathetic knowledge of the cultural heritage and the present conditions of the villages of India as a guide for the various prejects of social organization proposed therefor.

The material presented in this book describes clearly the jajmani system as one of the existent systems of interrelating the members of a Hindu village, economically and socially. This particular socio-economic structure is frequently found in North India, and perhaps elsewhere, though so far as the present reviewer knows, no full study of the extent and variations in this particular system has been made for the whole of India. Section I presents the

functional responsibilities that maintain under the jajmani system in Karimpur. This is essentially a description of the twenty-four castes which make up the population of the village, indicating the occupational employment of each caste, the ranking of the castes as to social status, and showing how the whole social structure is sanctioned and maintained by the code of Manu, immemorial custom, and civil law.

Section II sets forth jajmani compensations and rights in Karimpur. Here we gain a full and interesting picture of how the *jajman*, or the one who is served, becomes alternately, with certain variations among the castes, a *kam karne-wala*, or one who serves. To show this relationship a little more concretely, we quote from the author: "The carpenter during the sowing season must remove and sharpen the plough point once or twice a week. During the harvest he must keep the sickles sharp and renew handles as often as demanded. He must be ready to repair a cart whenever called upon by a customer, or to make minor repairs on the customer's house. In exchange he receives at each harvest, twenty-eight pounds of grain, for every plough owned by his client" (pp. 5 and 6) "The barber, grain parcher, potter, and washerman exchange services. Their inter-relationship is the most symmetrical relationship in the village. They each value the services of the other equally. They serve each other as they would serve other castes in the village, and expect no supplementary payments. Their demands upon each other are fairly constant, whereas those upon other services are not so constant" (pp. 61 and 62.) "The three Mahajan, or tradesmen families...engage in trade and keep small shops from which one can purchase grain, spice, sugar and tobacco. They are not the only tradesmen in the village. Two Brahmans sell similar articles...They all supplement their earnings with agriculture. Their claim {the Mahajans] to share in the jajmani system is one of caste and residence..." (pp. 46 and 47). On the whole, "Each caste in the village at some time during the year is expected to render a fixed

type of service to each other caste......The jajman speaks of the carpenter's family and all other families that serve him as his...*kam karne-wale* (i.e., workers) if they are of the serving castes, i.e., Sudras or lower. If the one who serves is a "Pandit" (title for a Brahman priest), a "Bhat" (astrologer), or another from the three upper divisions [of the caste system] he is referred to by these caste names "Pandit," "Bhat," etc., and not as a *kam karne-wale* (p. 6).

Certain perquisites usually accompany jajmani relationships; but payment in service, money, or kind, are clearly indicated under the various conditions established through experience and custom. And while the upper castes usually have greater freedom and greater advantage under the arrangements of this system, and the occupational functions are largely assigned to the respective castes, the economic resources of the village, nevertheless, including goods and services, are available for the support of the entire population. Thus there is in no real sense, a monopoly of the economic resources of the village, for the jajmani system inter-relates these activites so that each caste and each individual gets a share in the resources of the village, however poor or good those resources may be.

Section III sets forth certain disintegrative features of the Hindu jajmani system in this village. Reviewing a number of modern writers on the subject of change in the jajmani system as a functional variant in the ancient village commune, the author describes three of these current forces of disintegration. The first of these is the disruptive and evolutionary forces growing out of the relationships of the various racial elements in the population, particularly the Dravidian and the Mohammedan, due to usurpation or conquest. These interfere with, or complely upset, the old communal holding of land and the periodical redistribution of fields formerly practised in much of India, replacing it by the family system of holding, or the assigning of common land to officials, artisans, servants, and others. The second disintegra-

tive force breaking upon the jajmani system is the British system of government and law. For example, the Anglo-Indian land revenue system, in its direct relations with the individual *royts* (farmers), has tended to break up the community of interests in the old village system of land holding so that Government not only recognizes the individual as having rights in land, but likewise in the law courts. This has also done much to weaken the *panchayat* (court of village elders) in the village. Moreover, government free schools, staffed by teachers drawn from every caste, has tended to weaken the jajmani system. The third disintegrative force of the jajmani system, is the change in function of the various social elements of the village. The outcastes and lower castes, through conversion to Christianity and and Mohammedism, have freed themselves somewhat from the degrading service traditionally due their higher caste jajman The stress of need has also driven practically all castes into doing a certain amount of farming. Then, too, the importation from outside sources of cloth, hardware, food, medicines, etc, produced by modern mechanical methods, is a blow at the traditional callings of the village craftsmen, and is driving them back upon the land as unskilled agriculturalists. This movement increases the pressure of the population upon the land by causing more people to cling to the land than are needed to cultivale it. These disruptive forces, aided by a number of reform movements of a political and a religious nature, and by the improvement of the means of transportation, and other current factors in Indian society, are changing the traditional *jajmani kam karne-wale* relationships. Obviously, a growing number of Indians are entertaining serious doubts as to the infallibility of the jajmani system and the caste system of which it is a part.

Section IV is an evaluation of the Hindu jajmani system. The author, while criticizing some of the basic assumptions upon which the caste system, and its cognate, the jajmani system are founded, and while questioning

some of the practices which they entail, nevertheless, sees certain solid values in the jajmani relationships. Among these is a close integration of religion with the affairs of daily life which, together with the provisions for security and response vouchsafed by village life, have resulted in contentment, peace, and social solidarity. Though the asymmetrical, or uneven, relationships existing between high caste jajman and low caste *kam karne-wales* in some cases may be considered objectionable, nevertheless they usually afford a feeling of "protection and cherishment" on the part of the jajman, and of "fidelity and obedience' on the part of the servant, hence serve a useful purpose.

In summarizing the jajmani system, Dr. Wiser suggests that the following values should be protected and continued:

1. Its general contentment and peace should be retained. This peace and contentment are due to the spirit of co-operation which exists as an outgrowth of the jajmani relationship.

2. The readiness of the average villager to subordinate his interests to those of the larger group or community should be continued as a basis for a more symmetrical relationship. The abuse of this readiness to subordinate the interests of the individual has led to many existing weaknesses of the jajmani system, but a right use of this spirit may lead to a much higher communal life and more symmetrical and democratic inter-relationships than now generally exist.

3. The panchayt should be given back some of its old powers and have the whole-hearted support of the Central Government. The centralized administrative plan of government should thus be reconciled with the old communal autonomy that formerly maintained in the villages.

4. The social and the economic advantages made possible through the farmers living in a village centre rather than in scattered homes, should be cherished.

5. The solidarity of the community establishes units which should be utilized in relation to the Central Government.

6. The two important forces, education and religion, which were instrumental in establishihg this system, should be utilized to guide and direct its members in future action.

The studies which Dr. Wiser has made of the village of Karimpur are worthy exemplifications of the case method of sociological research; furthermore, these studies demonstrate the almost inexhaustible fund of valuable information which scholarly investigations of an Indian village may yield. Thus, in line with the recommendations of the Lindsay Commission Report, Dr. Wiser has begun a type of research that should be emulated by every higher educational institution in India. It is true that much valuable research in pure science and in such applied sciences as medicine, agriculture and economics has been made by many of the educational and research centres of India; but it is the writer's opinion that not enough research along *sociological* lines has thus far been attempted. It is also the writer's opinion that many agencies should promote co-operatively, in numerous localities throughout India, researches such as Dr. Wiser has made at Karimpur. Many worthy organizational projects in education, politics, religion, health, social work, and general community uplift,—all largely sociological in nature, have been undertaken under the leadership of government, Christian missions, other philanthropic organizations, and individuals. Though many of these undertakings have succeeded very well indeed for a time, others have either failed or enjoyed but an indifferent success, largely due, no doubt in most cases, to the fact that the originators and the leaders in these undertakings were guided more by sentiment than by pertinent facts. It is becoming clearer, with the passing of time, that all important undertakings in social organization, whether in India or elsewhere, need the guidance of fundamental scientific research in the group

relationships, group values, and group folkways of the society involved in the proposed undertaking. Leadership in rural India that is seriously wanting in an intelligent and sympathetic understanding of the social cultures and folkways of age-old and proven merit already possessed by the villages of that country, cannot enjoy a sustained success. It will find its own ignorance an insurmountable handicap to the undertakings it wishes to promote.

Dr. Wiser's *Hindu Jajmani System* should be of special interest to those who contemplate sociological research in Indian village affairs. Its method of approach and its findings point clearly the way. This book will also be of value, as collateral reading, in college courses in cultural anthropology, and will be especially useful in college or seminary courses designed for the professional preparation of missionaries for service in India and countries having similar climatic, economic, and social condition. Students of sociology generally will find this book of interest, and so will those who, for purposes of recreational reading and general culture, desire a dependable and worth while account of the modern Indian village.

J. L. HYPES.
Professor of Socioloy.

State College,
Storrs, Connecticut, U. S. A.
November 24, 1936.

PREPARING FOR A NEW DAY: PUNJAB ECONOMIC BOARD'S REPORTS ON RURAL LIFE, CONDITIONS IN MARKETS AND SALE OF GOLD

Lahore 13th November, 1936.

At a meeting of the Board of Economic Inquiry, Punjab, held on 12th November, 1936, under the chairmanship of Mr. M. L. Darling, C.I.E., I.C.S., Financial Commissioner, Development, the Secretary reported satisfactory progress of work. Three reports had just been published, four were in press and about half a dozen were under preparation.

New Times Bring New Needs

While agriculture is and for long will remain the premier industry of the Province, agriculture itself will not flourish without adequate markets, satisfactory and organised marketing arrangements and flourishing cities busy with industry and trade. It is because of the growing importance of the economic factor in our lives that the carefully prepared and expert reports of the Board of Economic Inquiry have an ever increasing importance. No business man in the Province should fail to have the "Business man's and Marketing" series, one of which is referred to below as just issued, no landowner should be without the "Farm Accounts" series and at least one or two of other "Village Surveys" and all Government officials, students of economics and social p.oblems, legislators and public workers should have many of these publications for ready reference.

New Reports

Of the three new reports just issued, the first is a detailed economic survey of the village of Suner in the Ferozepore District, a tract noted for high indebtedness and the lawlessness of its people; this report is the ninth in the series of "Punjab Village Surveys." The second report deals with the "Conditon of Weights and Measures in the Punjab" and indicates the urgent need for their standardisation and inspection. The third report, which is the first in the series of "Pamphlets" to be issued, deals with the "sales of gold and ornaments in 120 Punjab Villages in the years 1931-33. These reports can be had from any bookseller.

Reports in Press

The first of the reports in the press and very shortly to be published is the tenth "Punjab Village Survey in the Hissar District" which is so well known for its cattle breeding; also for high failures of crops as much of the

cultivation is dependent on a precarious rainfall. Some time back the Board issued a report on the economics of gut-making in the Punjab. As this deals with a part of the material used in the Sports industry for which the Province has gained an international repute, an Urdu edition is in the press and will shortly become available. The third report deals with some factors which affect the price of wheat in the Punjab in the big wholesale markets and dealings in future and is the second in the series of Wheat reports. The first related to the marketing of wheat by cultivators. Another report for early publication is "Current Punjab Official Statistics" which will make available to the public a guide to the vast amount of information available in the annual departmental reports of the Government.

Reports in Preparation

Among forthcoming publications may be mentioned "Farm Accounts in the Punjab" for 1934-5 and 1935-6, which will be the 11th and 12th issues respectively in this series ; in these reports costs of irrigation by bullock and electric power are compared and are useful on account of the attention now being given to utilise electricity in agricultural operations. "Family Budgets of Cultivators" (third in these series) ; "Cost of milk production at Lyallpur," "Multan Village Survey," "Use of Milk by Children in four Punjab Villages," "Punjab Food Prices, 192 -36,' "Cost of Living Index Numbers (Punjab), 1936," and "Ten Punjab Villages; are the other reports under preparation ; the Index Nos. are already being issued monthly n the Government Gazette.

Current Inquiries

The first among these is the economics of the leather and tanning industry in the Punjab – (the report will form the third in the Board's Business-men's reports ; the other two deal with the Gut and Lac industries). Last

year inquiries were conducted in about 300 villages to find out the relation between human fertility and economic status. It is intended to issue the reports in parts ; data for about 10,000 families have been tabulated.

Inquiries Contemplated

Suggestions for various new inquiries were considered. These included a Poultry Census, Mortgaging of Agricultural Land in Recent Years, the Oil-pressing Industry, Extent of Absorption of M.S.L.C. pass village youths in villages and towns. Among other references which received attention were the broadcasting of prices, the wool and meat trades and a nutritional survey.

Publicity

The Board expects to reduce the period between the completion of inquiries and publication of the results. Reports of the Board contain valuable information not only for the economic and the business-man but also for the general public. The Province is literally on the threshold of a new economic era and a trained public opinion is essential to a healthy development and balance between the social, economic and political forces at work.

What is an Acre?

5 yards by 968 yards	... ... contains	1 acre.
10 yards by 484 yards	.. ... ”	1 acre.
20 yards by 242 yards	.. ... ”	1 acre.
40 yards by 121 yards	.. ... ”	1 acre.
80 yards by 60½ yards	.. ... ”	1 acre.
70 yards by 68 1·9 yards	.. .. ”	1 acre.
220 feet by 198 feet	.. .. ”	1 acre.
440 feet by 99 feet	.. .. ”	1 acre.
110 feet by 369 feet	... .. ”	1 acre.
60 feet by 726 feet	.. ... ”	1 acre.
120 feet by 363 feet	.. .. ”	1 acre.
240 feet by 180½ feet	.. .. ”	1 acre.

World Agriculture

Planned Economy and the International Year Book of Agricultural Legislation

At a time when under the pressure of circumstances and later of deliberate purpose, State intervention in the economic field is being manifested to a constantly increasing degree, publications containing clear and recent information on the enactments adopted regarding questions of this order in the different countries, acquire a quite special importance. It is greatly to the interest of each Government to be in a position to obtain a thorough and timely knowledge of the solution proposed by the Government of another country of some particular problem of the kind that frequently arises also in its own land to the end that it may itself be induced to feel the need of discovoring solutions that may be still more felicitous.

In the picture of the legislation of the year 1935 measures on the trade in farm products have taken first place. The tendency to organize the marketing of farm products and to cencentrate the sale in the hands of public bodies or of bodies directly controlled by the State has been exhibited to a more marked degree than in previous years. This concentration, which is intended in the interest of the public to withdraw, economic activities of this order from the inevitable disturbances originating in competition, has resulted in establishing, in certain countries and in relation to certain products, a form of equality among producers as regards the risks of finding a market for their harvests and also as regards price fluctuations.

The International Year Book of Agricultural Legislation, prepared and published for many years past by the International Institute of Agriculture of Rome,

contains a detailed statement regarding these measures and the trend of Agricultural Legislation in 1935. The Year Book is a stout volume consisting of some 900 pages, provided with two tables of contents, thus greatly simplifying the work of consultation and reference, statistics of agriculture and trade, financial and customs legislation, plant and livestock production, legislation dealing with land tenure and agricultural training, plant diseases and pests, agricultural co-operation, agricultural credit and insurance, rural ownership and internal settlement, legislation on the relations between capital and labour in agriculture, legislation dealing with rural hygiene and the policing of the countryside—all these give their titles to the various chapters in which are grouped the laws, orders and regulations adopted on these subjects in all countries of the world. The most important provisions are reproduced in full, for the others the title only is given. The volume further contains a very complete introduction, supplying a review of the general trend of agriculture in 1935.

The International Institute of Agriculture which has as its main function the collection and publication of agricultural intelligence for the whole world, thus puts at the dispooal of statesmen, experts and scientists an excellent fount of information and of material for reference, forming a very happy complement of the series of periodical publications issued by this Institute, all of which have as their purpose the service of world agriculture.

The World Production of Fresh Cocoons and Raw Silk in 1936

On the basis of the official data, unofficial estimates and other information received by the International Institute of Agriculture, the following is a summary of the results of the 1936 sericultural season.

The season appears generally favourable in Europe save in Greece and thanks to the market revival in Italy,

total European production of fresh cocoons will this year be considerably larger than in 1935, being estimated, in fact, at about 80·5 million pounds 55 per cent. above that of the preceding year, but 18 per cent. below the 1930-34 average of 98·1 million, the decline of rearing in Europe has been very great in recent years, especially from 1931 onward; previously European production of fresh cocoons oscillated on the average around 132 million pounds.

In Asiatic countries the weather was in some cases unfavourable but results were on the whole fairly good and not very different from those of last year; for the total of these countries, excluding China and India, production of fresh cocoon is estimated this year at 761·0 million pounds against 779·3 million in 1933 (2·3 per cent less) and 895·1 million the average of 1930-34 (15·0 per cent. less), these years including two or three of very large production; in this connection it may be noted that Japanese production alone amounted to about 882 million pounds of fresh cocoons in 1930 and 838 million in 1933 against 758 million on the average of the five years 1925-29.

Very favourable weather has contributed to the recent rapid development of silkworm-rearing in Brazil; the production of this country is still, however, of small importance in the world total. There is also a very notable increase in the Soviet Union (Central Asia and Transcaucasia) to meet the growing requirements of the internal silk industry; from an average of 25·6 million pounds of fresh cocoons in 1926-29, production rose to 34·6 million in 1930-34 and about 46·3 million this year.

In the few African countries rearing silkworms to a very limited extent (Egypt, Tripolitania) weather during the season was in general unfavourable and results poor.

World production of fresh cocoons, not including China and India, is estimated this year at 889·1 million pounds, against 872·8 million in 1935, 1,028·9 million in 1930-34 and 991·6 million in 1925-29. On the basis of present cocoon production and with a necessarily approxi-

mate calculation, world production of raw silk in 1936, excluding China and India, may be estimated at 84 million pounds.

At the end of the 1935-36 season total visible stocks of raw silk were estimated at about 17,640,000 pounds, as against 22,100,000 on June 30th, 1935 and 28,66),000 on the same date in 1934. The constant decrease in the stocks of raw silk on the principal markets during the last three years might constitute during the present season one of the factors in favour of a rise in the price of this product in the more important importing and exporting countries, the more so as the world production of raw silk in 1936 is expected to be somewhat deficient and very probably lower than the average for the last ten years.

THE JOY OF LIFE

"I apologize to Your Excellency for the length of address. Out of the Biblical age of three score and ten I have run out three score of years already and I am now running through the remaining ten. But if I may venture to exercise the privilege which belongs to age and through Your Excellency convey a message of hope to my countrymen, I will say this that there is no joy in life greater than what you can have by work of the kind that lies ready to hand here in the village. Your Excellency, I have watched your own career of success with pride and admiration. But if ever you feel tired of the dust and turmoil, and the storm and the stress of the life of a politician, I have no hesitation in recommending to Your Excellency the kind of work that is being attempted here."

—*Conclusion of a welcome by Mr. N. A. Dravid to the Governor of the C. P. at laying the cornerstone of a Rural Centre of the Servants of India Summer 1936.*

STATEMENT SHOWING OUTTURN OF KHARIF CROPS

16 ANNAS DENOTING A NORMAL CROP

	Maize	Early rice	Late rice	Juar	Bajra	Cotton	Tobacco	Pulses	Remarks
Dehra Dun ..	.	.	..	.		..	..	..	15 annas on an average
Meerut ..	12	12		12	12	10	..	..	
Bulandshahr ..	14/12	..	..	14/12	9/8	9/8	..	14/12	Wet/Dry.
Aligarh ..	12	..	..	12	12	9	..	..	
Muttra ..	..	..	..	..	..	..	..	..	14 annas average.
Agra ..	..	..	..	16	16	9	..	16	
Etah ..	14	15	..	12	14	13	14	..	
Bijnor ..	nil/12	14/12	..	..	nil/10	..	..	nil/12	Irrigated/Dry.
Budaun ..	9	12	..	11	10	11	..	..	
Moradabad ..	15/13	14/13	14/11	/12	/12	13/13	..	/112	Irrigated/Dry.
Shahjahanpur ..	6	13	14	6	7	..	10	7	
Pilibhit .	12	13	12	12	9	12	..	9	
Farrukhabab ..	6	11	..	10	10	10	..	12	
Etawah .	12	15	..	14	14	14	..	..	
Cawnpore .	8	14	..	10	..		..	..	
Jhansi ..	14	..	..	14	14	14	..	.	
Jalaun ..	..	..	..	15	15	.	14	13	
Hamirpur ..	..	16	..	14	15	12	16	15	
Ghazipur .	12	12	13	13	12	..	..	..	
Ballia ..	11	11	11	..	..		..	..	
Basti ..	9	12	13	..	..	.	..	11	
Azamgarh ..	11	12	12	..	..	..	..	12	
Naini Tal .	12	16	..	10	10	12	..	..	
Garhwal ..	.	..	..	..	..	..	..	..	14 annas average
Unao .	8	8	15	10	12	8	14	..	
Sitapur	9	8	9	8	13	..	16	14	
Hardoi .	4	10	..	7	9		..	12	
Kheri .	6	11	11	9	11	12	12	11	
Gonda ..	8	11	12	..	12	..	14	..	
Bahraich ..	3	12	13	9	12	..	14	12	
Sultanpur ..	11	13	11	11	12	..	..	10	
Partabgarh ..	..	15	15	13	13	..	.	..	
Bara Banki ..	10	13		11	11	.	..	15	

By order,

A. A. WAUGH,

Secretary to Government,
United Provinces.

Meteorological Observations

DECEMBER, 1936

Date	Max. Temp.	Min. Temp	Mean Temp	Percentage of Humidity.	Pressure of the Atmosphere	Wind direction.	Rain for the day.	Rain since Jan. 1	Remarks.
1	85·0	57·0	71 0	70·0	29 75	E.	Nil	50·0	
2	83 0	54 0	68·5	72·0	29·79	E.	Nil	,,	
3	81·0	54·0	67·5	89·0	29·71	E.	Nil	,,	
4	82·0	54·5	68·25	85·0	29 74	S.E.	Nil	,,	
5	84	49·5	66 75	100 0	29 76	S E.	Trace	,,	
6									
7	75 0	49 0	62·0	79·0	29·82	S.	Nil	,,	
8	76·0	46 0	61·0	100·0	29·80	S.	Nil	,,	
9	77·0	49·0	63 0	90·0	29·80	N.	Nil	,,	
10	79 0	52·5	65·75	90·0	29·71	N.	Nil	,,	
11	82 0	52·0	67·0	93·0	29·72	N.	Nil	,,	
12	82·0	51 0	66 5	93 0	29 78	S.W.	Nil	,,	
13	81 0	51 0	66·0	92·0	29 75	S.W.	Nil	,,	
14	79·0	52·0	65 5	90·0	29·76	S.W	Nil	,,	
15	77·0	52·0	64·5	90	29 68	W.	Nil	,,	
16	79 0	53·0	66·0	82·0	29 68	W.	Nil	,,	
17	79·0	51·0	65 0	75·0	29·68	W.	Nil	,,	
18	83·0	56·0	69 5	95·0	29·66	N.E.	0 1	50·1	
19	81·0	58 0	71 0		29·64	N E.	Nil	,,	
20	60 0	51·0	55·5	80·0	29 62	N E.	0·58	50·68	
21	75 0	58 0	66·5	97 0	29·64	N.E.	Nil	,,	
22	68·0	45·0	56·5	93·0	29·72	N.E.	Nil	,,	
23	64·0	42·0	53·0	89·0	29·78	S.W.	Nil	,,	
24									
25									
26									
27									
28									
29									
30									
31									

JANUARY, 1937

Date	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Pressure of the Atmosphere	Wind direction.	Rain for the day.	Rain since Jan. 1	Remarks.
1									
2									
3									
4									
5	64·0	43 0	53·5	91·0	29 62	Calm	Nil	Nil	
6	80·0	46 0	63·0	85·0	29·7		Nil	Nil	
7	68·0	40·0	54·0	85·0	29·72	S.E.	Nil	Nil	
8	68·0	37·0	52·5		29·72	S.S.E.			
9									
10									
11									
12									
13	45	[illegible]6	55·5	85·0	29 79	S.			
14									
15	66·0	32·0	49·0		29·82				
16	71·0	33·0	52·0		29·75	W.			
17	68·0	34·0	51·0		29·81				
18	63·0	38·0	50·5		29 8				
19	74·0	38·0	56·0		29·22	N.			
20	80·0	43·0	56 0	60·0	29·73	N.W.			
21	81·0	47·0	64·0	30·0	29·78	S.W.			
22	64·0	40·0			29 78	S.W.			
23	75·0	41·0			29·8	N.W.			
24									
25	64·0	38 0			29·76	Calm			
26	74·0	39·0		66·0	29·73	W.			
27	76·0	40·0		68·0	29·74	W.			
28	66·5	44·0			29·75	S.W.			
29	75·0	45·0			29·68	S.E.			
30					29 68				
31									

SOMETHING NEW!

CONSIDER THESE FIVE IMPORTANT FEATURES OF THE U. P. PLOUGH

1. **ECONOMY**

   Cuts production costs by permitting the ploughing of hard dry soils with oxen instead of tractors. Makes possible cultivation of more land by better distribution of work throughout the year. Hot weather ploughing is made possible, saving first rain, organic matter of crop refuse and early planting with resultant increased yield.

2. **ADAPTABILITY**

   It can be used to invert soil, to plough the ground when it is hard and dry, and is the only entirely successful bullock plough for making sugarcane furrows and ridges and for earthing up cane. The plough operates successfully in a wide variety of conditions.

3. **DURABILITY**

   It is an all-steel plough with steel beam and handles. Shears can be sharpened by heating and hammering. It will give long low cost service.

4. **CHEAPNESS**

   In comparison with other ploughs of a similar size but able only to invert the soil, the U. P. plough is cheap. With inverting and hard ground bottoms it is priced at Rs. 35 each. The furrow maker costs an additional Rs. 15.

5. **INTERCHANGEABILITY**

   Loosen two bolts and the bottom is removed. Any of the three bottoms can be replaced by an unskilled man tightening the same.

   A splendid plough for the larger cultivator growing sugarc

For further particulars write to

cattle m

AGRICULTURAL ENGINEE

a striving

Allahabad Agricultur

Sam Hig, U. P

Allahaba

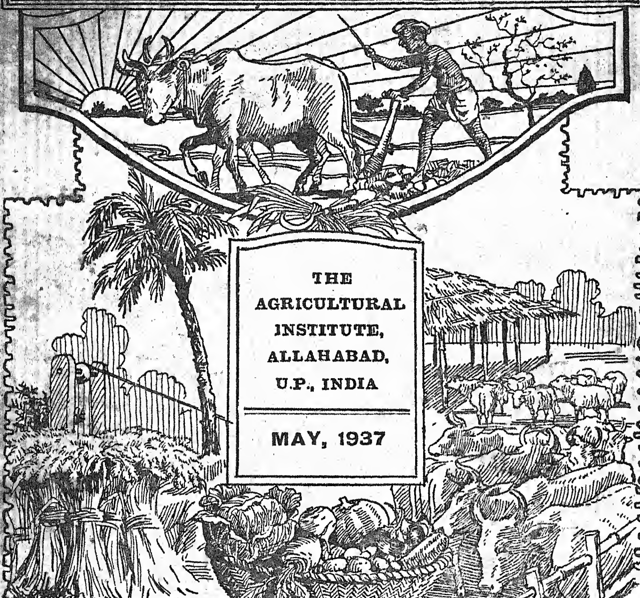
VOL. XI] [No. 3

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE
AGRICULTURAL
INSTITUTE,
ALLAHABAD,
U.P., INDIA

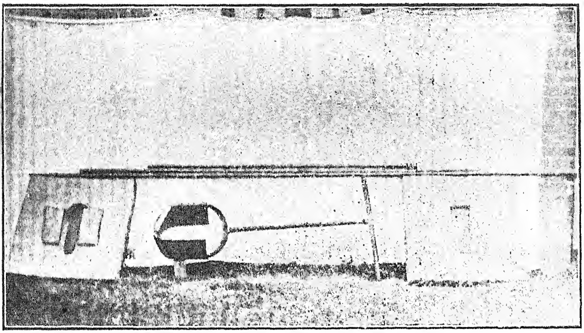
MAY, 1937

"Better quality pasture and better quality cattle m
better quality people and are, therefore, well worth strivin

Dr. Sam Hi , U. P

Please menti

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

Subscription Rates.

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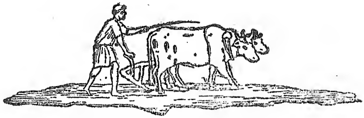
Vol. XI] **MAY, 1937** **[No. 3**

Table of Contents

THE ALLAHABAD FARMER



VOL. XI] MAY, 1937 [No. 3

Editorial

This issue of the Farmer goes to press at the close of the fullest year in the history of the Institute. A larger student body than ever before together with an enlarged programme of research has enlarged the opportunities of the Institute considerably. Perhaps the future will show that as important as anything in the past year was the beginning of the Home-Making Department for women. Elsewhere in this issue will be found two letters written by the girls who first enrolled in this course which are suggestive of the values which they feel they have received. The directors of this course are now looking forward to a much enlarged enrolment in the second year of the course beginning July 18th of this year. The prospectus may be obtained from Mrs. E. F. Vestal, at Mount Hermon, Landour, Mussoorie.

We look forward now to the new school year hoping that it may fulfil the opportunities which it brings and hopeful that our circle of co-operating friends will be enlarged so that we may have the resources to meet these opportunities.

Farmers' Fair

The last three days of February witnessed the annual Farmers' Fair featured by exhibits, contests and demonstrations relative to the agricultural work of the Institute. As in former years the exhibits of handicraft and crops brought by cultivators attracted considerable attention, and the list of popular contests was extended to include a milking contest for 'gwalas' which proved quite popular.

It is very satisfying to note the increased interest of the cultivators each year in this fair. This year more than ever before the visitors of the fair were predominantly rural people, cultivators of land to whom agricultural improvement can mean so much. The arrangements for this year's fair were carried on under the chairmanship of Dr. B. H. Schneider and he was ably assisted by other members of the staff and especially by the student body of the Agricultural Institute. Each student had a definite part in the programme and the student participation was more enthusiastic than in previous years.

Address of Her Excellency Lady Linlithgow at the annual prize-giving of the Lady Irwin School for Girls, Simla :— * * * Just one word more. Because you have had the benefit of good education, do not think it is beneath your dignity to help in the home. It has come to my knowledge that in many cases parents complain that hand in hand with higher education comes the idea on the part of the girls that household work is unsuited to their dignity. Surely, this is a lamentable point of view. What could be more satisfying than having a home which by your own efforts is clean, tidy and pretty and there is nothing of which you should be more proud than ability to cook an appetizing meal. In conclusion, remember the words of the poet "knowledge is proud that he has learned so much. Wisdom is humble that he knows no more".

IMPROVEMENT OF PASTURE

DR. SAM HIGGINBOTTOM, M.A., D. PHIL.
Principal, Agricultural Institute.

By pasture is understood land which has been laid down to grass on which cattle feed themselves. By permanent pasture is meant land that has grass year after year with no rotation of crops. In many parts of the world clover and grass are grown for a year or two as part of a rotation, then the land is put to some other crop. Such are temporary pastures. Most of the village pasture of India is permanent. Providing good pasture is the most economical way of feeding cattle, buffaloes, sheep and horses.

As one rides in the train in India one is struck by the very large areas of land, frequently desert-like, which are left for the cattle to roam over. Sometimes, during the rains, there is some green grass, but for most of the year it looks as though cattle were turned out on to a grassless waste.

As one observes the cattle on these village grazing grounds, it is unusual to see cattle in good condition. Most of the cattle look underfed, lack energy of life; many of the young stock appear to be stunted and dwarfed; yet there is a constant cry for more land to be devoted to grazing. It is difficult to understand how more of this type of pasture would improve the lot of the cattle turned out on it. For more than half the year, the cattle seem to be in a state of semi-starvation.

Where the grass is good and nutritious and sufficiently plentiful, good grazing is the cheapest way of maintaining cattle, because there is no expense of cutting and carrying the food to the cattle ; the cattle cut and carry their own. One of the secrets of the success of New Zealand as a dairy country is the excellency of its pastures. The pastures of Great Britain are famous and cattle do well on them. In both New Zealand and Great

Britain the cattle need little or no additional food during the grazing season. The grass is sufficiently nutritious and abundant.

In spite of the excellence of the pastures of Britain, the great and ancient universities of Oxford and Cambridge, in recent years, have been making extensive studies into the value of pasture and the improvement of pasture. In other parts of Britain, especially in Scotland and Wales, research has been undertaken and valuable information discovered. The yield and quality of the pasture has been greatly improved due to these investigations.

India, in view of the fact that it possesses one-fourth of the world's cattle, and that so much of its land is devoted to pasture, can well afford to do some extensive research looking to the improvement of its pastures. In India, up to the present, little work in this important branch has been undertaken. India is so large and conditions vary so much, that it is difficult to state in one brief paper what applies to all the different parts of this vast country. So I concern myself chiefly with the densely populated areas. The present pastures in the congested areas of India are usually overgrazed; that is, before the grass has had a chance to grow sufficiently to provide a reasonable amount of food for the cattle, it is grazed off. Every new blade of grass before attaining an economic growth seems to be eaten or trampled. The pasture gets no period of rest or time to recuperate. Very frequently weeds which the cattle will not eat appear in the pasture. Instead of these weeds being cut before they give seed, they are usually left to go to seed, with the result that the next year many new weeds spring up, and thus reduce the amount of land in the pasture area available for growing good grass. Two plants cannot occupy the same ground at the same time. If the weed occupies the ground, the grass does not and *vice versa.*

Very frequently usar or alkaline land which will grow little of anything is set apart as pasture. Until these salts are removed, such land has little value as

pasture. Also land which is under-lain with kankar or impervious clay, so that there is not proper drainage and very little plant growth, is set apart as pasture. This land must be opened up and proper drainage established before good pasture will come into being. Again many pastures are badly gullied and eroded. Every year good soil is washed away and the pasture becomes less and less productive. Erosion must be controlled in order to keep up the pastures. In general we might say that most of the present pastures in the congested areas of India could not be made to produce less than they do. Through misuse they have reached their minimum. They are not really pasture, they are exercising grounds. They have been so badly abused and improperly cared for that their present production is the irreducible minimum.

In view of the tremendous economic value of good pasture, it is necessary to improve the present pastures of India. This can be done. Fortunately the lessons learned from successful experiments in other countries can in part be applied to India.

The first step in the improvement of pasture in India is to divide the total pasture of the village into five approximately equal parts; then to permit the village cattle to go on to one plot only, to keep them off the other parts; that is to graze all the village cattle on plot number one for four or five days, then graze plot number two for four or five days, giving plot one a rest, then on to plot number three for four or five days, then on to plot number four, and last let the cattle on to plot number five. Thus the village cattle would be permitted for periods of four or five days at a time to graze only one plot. The other plots would be rested and the grass allowed to grow. This system of rotational grazing is known as the Hohenheim System. During the monsoon and period of rapid growth it might be that the period of grazing on one plot should be reduced to three days, so that on the sixteenth day, after going round in rotation, the animals would be back on plot number one. Young grass five or six inches high is much more nutritious

than older and fully matured grass. During the drier parts of the year four days or five days on each pasture might be better. But this regular rotation of pastures will enable the grass to grow on the plots not being used to a sufficient amount to give the cattle enough food.

The second step is that all harmful weeds should be cut before they seed. Also if grass has been left over which is tough and fibrous, which the cattle will not eat, that should also be cut down. Cattle prefer the newer, leafier grass.

The third step is the introduction of the best pasture grasses. There should be a variety of grasses in the pasture; some that grow well at one time of the year, some at another. The idea is to have throughout the year some nutritious grass always available for the cattle. Fortunately in India there are grasses which will grow, so that some one or more are green and growing at all times of the year. Thus the pasture is available throughout the year. North India is rich in good pasture grasses, such as banderia, genea, anjan, doob ; also many good grasses can be introduced as rhodes, paspalum, kikuaya. Unfortunately, we know of no good clover in the plains of India. If we could find one to mix with the village pastures it would help to keep up the nitrate supply and thus maintain the fertility of the soil.

The fourth step is to give proper plant food to the pasture. Many pastures lack or are deficient in those essential elements of plant food necessary for animal well being, so some fertilizer to make up the deficiency must be applied. After the cattle have grazed a plot, some sort of brush harrow or chain harrow should be run over the pasture to break up the droppings. If the manure from the cattle as they graze is allowed to remain on the pasture, it will do much to maintain the fertitity of the soil, but it must be distributed evenly by harrowing. In some places a top dressing of lime, or some sort of phosphate, as basic slag or ground bone or superphosphate, or nitrogen in the form of sulphate of ammonia or chilean nitrate, would pay well to give the pastures a start. Farmyard manure, village compost and poudrette, might

also be spread over the pasture and harrowed in. If all the bone from animals that die in the village could be pulverized with a hammer mill or by a stone mill, such as is used for grinding kankar or lime, and spread on the pasture, great improvement would take place; the quality of the grass would be better. Pusa has worked out a cheap efficient method for making bone available in the village. Sometimes the land is so badly infested with weeds and grasses unsuitable for pasture, that plowing and cropping for a year is the only way to rejuvenate the pasture.

Wherever the rain falls between the first of July and the first of October, and the rest of the year is comparlatively dry, there are several months when the pasture needs irrigation to give good grass throughout the year. Fortunately at times water is available, such as when the rabi crops are past the time of need for irrigation, before the kharif crops require it. Irrigated pasture would pay well at normal rates for canal water. Again care must be taken to keep cattle off pasture that is so wet that hoofs destroy the sod. There is no reason, if pastures were properly cared for, why an ordinary herd of Indian cattle should need stall feeding, except when the oxen are working hard, and the cows yielding heavily. Most of them would thrive if they got enough good pasture grass. In some places the rainfall is so heavy that much of the soluble plant food is washed out of the soil. In such areas an annual application of manure would be needed.

The quality of plants varies with the amount of plant food available. In general, poor land deficient in plant food produces crops of poor quality, while land rich in available plant food produces abundant crops of good quality. Thus rotational grazing, proper drainage, erosion prevention, manuring, irrigation and keeping the cattle off pasture that is waterlogged, will not only increase the amount of grass, but will also improve the quality, so that a smaller amount of this nutritious grass will keep the cattle in better condition than larger amounts of the poorer grasses.

So far no extended research in India has been carried on to discover the cattle-carrying capacity of Indian pastures. Such work should be put in hand soon. Nearly every other agricultural country in the world is working hard at the problem of pasture improvement.

If my memory serves me correctly, at Kilmarmock, Scotland, 42 acres were divided into seven paddocks of 6 acres each, upon which were grazed sixty-five head of dairy cattle with an average yield per cow of over nine thousand five hundred pounds of milk per lactation period. They were grazed on this from May 1 to Nov. 1 They were kept on each paddock for four days. After each grazing period the droppings were harrowed in. This gave a rotation of twenty-eight days. The cattle were in good condition.

It is difficult to say how much stock pastures would carry if properly cared for in India. But in tropical Queensland where grasses similar to those grown in India are grown and can be grown throughout the year, ten to twelve dairy cattle per acre per week is considered normal. There the paddocks are made as small as can be well and clean grazed in the period of the rotation. On this basis, if an Indian village has a hundred cattle then the pasture required would be five paddocks of ten acres each, upon which the cattle would graze in rotation, for periods of three to six days each, depending upon the time of the year. The grass should be not less than six inches tall when the cattle are turned in upon it and they should graze it clean. No more cattle should be allowed on this until its turn in the rotation comes round again.

To sum up: We already know enough of the possibility of improvement of pastures to warrant extensive research in India. This improvement in pasture along with the improvement in cattle that is now going on would do more than anything else to make cheaper milk available for the Indian people, than which there is no more desirable food reform. Better quality pasture, and better quality cattle, mean better quality people, and are therefore well worth striving for.

NEW HOME-MAKING COURSE

I

On the 10th of August, 1936, while I was glancing over the newspaper, I noticed an article in it headed "Women's Course." I read it through and then said to myself, "I'll be a very fortunate person if I get an admission in this Institute." Then I asked my father's opinion about it. Finding my father in favour of it, I sent an application to the head of the department, Mrs. Higginbottom, and received the reply saying that she would be very pleased to have me come. I reached Allahabad on the 31st of August.

The Agricultural Institute and Farm are separated from the city of Allahabad by the River Jamna. It is a very beautiful place. Since it is a farming institute, every place where I could glance looked graciously green. In some places I noticed the beautiful flowers, blooming in their full colours and spreading their sweet fragrance in the gentle evening breeze. It all looked as though nature had done fine embroidery on the soft green velvet.

Then I saw a playground where the college boys were playing hockey, and the clear sound of the whistle came to my ear at intervals—a signal for the hockey players. The appearance of these boys was so pleasant that no one could guess which side was winning. In spite of their hard work during the day, they looked quite happy.

Then in a little while I noticed the moon and the stars finding their way through the mists and the silvery light spread all over the world. The moon came up in her full majesty as a queen followed by her attendants, and reflected her full light on the Jamna's breast. The lights of the houses which are on the other side of the river were also reflected in the water. It looked as though someone had prepared the illumination for the welcome of a king.

The next day, the 1st of September, my classes began. We have the following subjects in this department:

Gardening	Bible
Economics of home and family	Hygiene
Current literature	Handicraft
Dairying	Child training
Sociology and social service	Cooking and nutrition
Nature study	

Gardening, dairying and economics were new to me. I take much interest in gardening and dairying, because I know one cannot live in this world without food. So it is necessary to know from where we get the different kind of crops and vegetables and how we can have better crops; what kind of soil is needed for certain crops and if the soil is not good, how we can make it fertile, and so on. And now I also know what are the advantages of having our own garden and how economical we can find it.

In my dairy classes I have learned butter-making, dahi, cheese-making and the care of animals and about their food. In this dairy farm we have cows of different breeds which give from 4 to 25 seers of milk each day; also buffaloss and goats, which give milk in quite satisfactory quantities. Then we have good kinds of hens, sheep and hogs, from the products of which the Institute adds to its income.

Then comes the home economics. Home economics mostly depend upon the woman of the house and it is necessary for girls to learn about this. Those mothers who are lacking in this line of education are also cordially invited to join this course It is expected that this training will lead to an Intermediate examination certificate when Government recognition is secured and, in future years, we hope it will lead up to B.Sc. and M.Sc.

In other educational lines girls and boys are going parallel to one another, why should girls be backward in this line? Why should they not equal the boys in this line, too? If the girls only knew the value of this course there would be thousands of them who would appreciate it. If we remember just a few years ago it was hard for Indian women to take part in public and social work; but now notice how many women have gained fame and the love of the people of the country, just because they have worked hard for the betterment of their own country.

I am ashamed to say that 94 per cent of the Indian population is illiterate and this illiteracy has killed the desire for improvement. It is not too late; there is still time for us to wake up and do something, not for our name's sake, but for the sake of our own country. It is good to have knowledge in every kind of line and be useful to others.

ANGELA CUTTING.

II

The following is a copy of a letter written by the Chief Inspectress of Girls' Schools when she heard about the plan to start a woman's department in connection with the Agricultural Institute:

Allahabad, July 27, 1936.

DEAR MRS. HIGGINBOTTOM:

I was very glad to learn in detail the course you intend to teach in Domestic Science and Agriculture. At present Domestic Science is a subject on the curriculum for both High School and College; but teachers in Domestic Science are very scarce. We send candidates to Delhi for training. If your institution is well organized and run, you would certainly be filling a need the province feels. I would advise you to recruit High School Passed girls, trained or untrained. If they are untrained, they would be given preference in admission into training classes if they have a previous course in Domestic Science. I shall come round and inspect you when you feel you are ready for inspection.

Yours sincerely,
E. C. WILLIAMS.

Last year I was in Dehra Dun, taking the training to become a teacher, but on account of my ill health I had to leave that place and go to Roorkee to my sister. But I was not happy to be idle and wanted to do something. In September this institution was opened. Somehow Mr. Moore, one of the missionaries in Shikohabad, heard about it and he sent a letter to me saying: "This course would be very good for you because you would get good physical exercise." Since I was interested in practical work, I asked the details of it and he wrote to me. I was very glad to come because I was given the opportunity to see the original letter from the Chief Inspectress, a copy of which is given above. This letter encouraged me more and more.

In this course we learn gardening, home and family economics, current events and literature, dairying, rural social service, cooking and nutrition, sanitation and hygiene, handicraft and child-care. We also have some lessons in music, shorthand, and typing. I never before took interest in gardening but now I feel that it is a very good thing to have one's own garden. Sociology is a study which is much needed in India to teach the villagers and those who have not had the advantages which we have had.

There are many girls who do not know how to cook. Cooking is a great deal of fun. I enjoy it partly because we get many things to eat. We learn to cook many things, such as vegetables, sweets, and things made with milk.

There were some Hindu girl students in the Government Normal School who joined this course and were happy to learn all these things. Sometimes they come back to see their garden.

In sewing we can learn anything we want. A lady doctor teaches us hygiene and we studied a book on "Care of Babies," with practical lessons, and in the dispensary learned many things as she explained them to us. All of you know that when you want to learn music you have

to spend a lot of money and years, but here we can learn for very little.

You will know from reading the Inspectress' letter how important this course is. I won't be able to come next year but I hope to visit the school some time.

Thank you for sparing your time in reading this article. I hope you will enjoy reading it and try to come here next year.

—MERCY ROBERTS.

GUIDE TO PUNJAB GOVERNMENT REPORT

In accordance with their policy of issuing reports of general usefulness in addition to strictly scientific publications which are of value to a relatively small number of people the Punjab Board of Economic Inquiry have in preparation a "Guide to Current Punjab Official Statistics." There is available in the annual reports of the various Government Departments an immense amount of useful information of which the public is largely ignorant. In this guide the latest issues of these reports, of which there are about forty, will be dealt with. Each report will be treated separately; first a general description of the contents of the text of the Report will be given and then the subjects contained in the annual statistical tables will be presented alphabetically and reference given to the tables and the specific columns in which they are dealt with. It is expected that the Guide will be useful not only to Government officials and to the new Punjab Assembly members, but also to businessmen, professors, students and the reading public in general, since everyone requires statistics on some particular topic at one time or another but does not know exactly where to get them. It is hoped that the Guide will be available early in March next.

BARLEY

By Ram Krishan,

Student, Agricultural Institute

Barley is one of the main staple crops of India. It occupies about 6·8 per cent. of the cultivated area of this country. The total area under this crop generally ranges between 6 and 8 million acres. The total area under barley in 1931-32 was 6,495,000 acres. In 1931-32, the area under barley in each province was reported to be as follows (Year Book of India 1935-36) :—

Provinces	Barley Acres	Estimates of yield in 1931-32 in thousands of tons.
Ajmer-Merwara	64 767	12
Assam	..	..
Bengal	87,500	27
Bihar and Orissa	1,356,400	51
Bombay	35,161	10
Burma	..	..
C. P. and Berar	16 851	2
Coorg	..	..
Delhi	12,711	2
Madras	2,911	..
N. W. F. P.	152,441	53
Punjab	629,480	161
U. P.	4,137,004	167
Total ..	6,495,226	2,388

This shows that the U.P. only contribute about 60 per cent. of the total produce of barley in India.

Within the United Provinces the following 21 districts may be considered the chief barley growing places, because they produce about 70 per cent. of total barley raised in the Province :

Bulandshahr	Balia
Aligarh	Gorakhpur
Etah	Basti
Budaun	Azamgarh
Moradabad	Unao
Farrukhabad	Sitapur
Cawnpore	Hardoi
Allahabad	Kheri
Jaunpur	Bahraich
Ghazipur	Sultanpur

Pratabgarh.

The chief market for the surplus Indian barley is the United Kingdom. The total export of barley in 1928-29 was:—137,847 tons. Out of this 27,077 was exported to the British Empire. Karachi is the main exporting port for barley.

Habitat: In India it is grown from the plains to altitudes of 14,000 ft. above sea level. It is grown throughout the temperate and extratropical regions of the globe.

History:—Barley, like wheat is one of the most ancient of cultivated crops. Dr. Bretschneider says that barley was one of the five cereals sown by the Emperor Shen-nung of China about 2700 B. C. According to Decandolle the two-rowed barley was cultivated by Semitic and Turanian peoples, while the six-rowed barley was the most commonly cultivated in antiquity. It was known to Greeks. Roxburgh believes that the six-rowed barley was the only kind of barley grown in India at the end of the last century. It is used in Hindu cermonies and the antiquity of the Sanskrit name 'yava,' indicates that the grain was also known to Aryans since very

ancient times. The *Ain-i-Akbari* also shows that barley was considered to be one of the most important crops of Afghanistan and Kashmir during the reign of Akbar.

The two-rowed barley (*Hardeum distichum*), alone has been discovered in the wild state in several parts of Central Asia. The six-rowed barley (*Hardeum hexastichum*) was cultivated in Europe, Asia, and Africa in olden times. The four-rowed barley (*Hardeum vulgare*) is the staple of European cultivation now. Probably the four-rowed and six-rowed barleys are derived from the wild two-rowed variety.

Cultivation :—It is a rabi crop. It is sown in October or November and harvested in early April. It is sown either by itself or mixed with wheat, or with gram, peas, lentils, linseed, rape or mustard. The most favoured mixture is barley and gram. Barley and wheat as a mixture is not very common, but barley as a surface feeder and wheat as a sub-soil feeder may be grown together in rich soils.

It is grown on soils which are light and sandy and not highly manured. It does not require as thoroughly well-prepared a seed-bed as wheat. The number of ploughings given is from 2 to 6.

Seed rate :—In North-East India, the seed rate for barley is very high. It is from 60 to 120 lbs. per acre. The seed rate is high because the percentage of germination decreases a great deal during storage. There is a great influence of atmospheric conditions on the germination of Indian barley. The Indian cultivator stores his barley for seed purposes in mud urns.

The germinating percentage has a great influence upon the export of barley from India. Barley required for malting purposes (or any other use involving its germination) should not be exported from Calcutta after May. After May, barley in North-Eastern India is to be regarded as having been subjected to atmospheric condition that have a deleterous effect upon its germination. Unless extraordinary storage precautions be taken,

barley in this region during the period of the monsoon will have its germination reduced by anything up to 25 per cent. Thus we see where and why the cultivator's seed rate is high.

Irrigation:—Irrigation is not required where the annual rainfall is quite sufficient, such as the Tirhut Division in Bihar and Orissa, and Meerut and Rohilkhand Divisions in the United Provinces of Agra and Oudh. Where necessary the crop is irrigated, but it is lighter than wheat. One or two waterings are quite sufficient.

Area of barley under irrigation in 1931-32 in each Province :—

Province.	*Acres.*
Ajmer-Merwara	41,903
Assam	..
Bengal	5,436
Bihar and Orissa	130,838
Bombay	20,013
Burma	..
C. P. and Berar	1,784
Coorg	..
Delhi	2,445
Madras	2
N. W. F. P.	60,517
Punjab	196,858
Unite Provinces	1,902,993
TOTAL ..	2,362,789

Interculture.—It is a hardier crop than wheat and does not require the same amount of weeding and irrigation. (It can be also grown more successfully in different climates than wheat, which does not do so well in warm and moist regions as barley does).

Very little interculture is required, but rank growth of weeds should be checked.

Yield.—An ordinary yield per acre on irrigated areas is 12 to 16 mds. and on unirrigated areas it is 8 to 10 mds. of grain per acre. The average yield of :

India	11.25 mds.
America	13.25 mds.
Japan	35 mds.

Uses.—(1) Staple article of food among poor classes. Barley mal (*Saltu*) prepared after parching is eaten largely by up-countrymen and is given to animals also.

(2) Employed in the preparation of beer or spirituous liquor.

(3) Used for malting and brewing. Malt is prepared by sprouting the grain in a cool moist room; much of the starch becomes converted into sugar, after which the grain is transferred to the kiln where it is thoroughly dried. Malt is used in the preparation of beverages, malted milk, etc.

(4) Used as a horse and cattle fodder. In some parts of India the crop is cut two or three times when quite young without marked injury to the final yield of grain. The straw makes a fairly good fodder when cut up as bhusa, but is inferior to that of wheat. Barley straw is not a safe straw to give to horses and cattle, as it is liable to cause colic being bearded and spiny. It may be used for litter with great advantage.

The feeding value of barley straw is the same as of gram, but it is more suitable to dry and working livestock. Gram is better for cattle in milk.

There is a greater demand for barley bhusa in the market than for wheat bhusa. In villages barley bhusa is considered to be useful for milch cattle, but wheat bhusa is preferred for draft cattle. Barley bhusa is generally considered to be cold in nature.

The grain is a good feed both for horses and cattle, either given alone or mixed with gram.

(5) "Pearled barley" (grains with lemma, palet, and bran removed) is used in soups and as a "breakfast food."

(6) The hooded varieties are grown chiefly for hay.

(7) Barley may be used as a pasture crop, a nurse crop, or as a smother crop. A pasture crop is for grazing; a nurse crop is planted with something else, as clover or alfalfa which it protects in the early stages; a smother crop is used to prevent the growth of weeds.

(8) Used in medicine. It is a demulcent and easily digested and is much used in the dietary of the sick. Malt extract is very popular, both as a nutritive and demulcent and as a means of rendering other medicines palatable.

Properties:—The chemical composition of ordinary husked barley is given as follows:—

According to Church:—

Water	..	12.5 parts.
Albuminoids	..	11.5 „
Starch	..	70.0 „
Fat	..	1.3 „
Fibre	..	2.6 „
Ash	..	2.1 „
TOTAL	..	100

The nutritive ratio here is 1:6.3 and the nutrient value 84.5.

Root habits of barley:—The root system in all types of barley consists of:—

(1) The shallow roots.

(2) The deep roots.

Both kinds of roots arise at the base of each tiller. One set of roots goes horizontally forming the shallow root system and the other set takes a downward course and forms the deep root system. The roots forming the shallow root system extend out in all directions from the base of the plant. The maximum length ranges from

22 cm. to 48 cm. in various types and the roots give out laterals throughout their course. The laterals are 9 cm. to 16 cm. long and branch and rebranch in turn, forming a dense network in the first one foot or one and one-half feet of the soil.

The roots constituting the deep root system take up a more or less tortuous course downwards and are freely branched, the branches running horizontally for some distance and then going downwards. The depth to which these branches are quite abundant is termed the working depth and varies with different types from 50 cm. to 120 cm. The last 10 to 25 cm. of these roots are very thin and rarely branched.

In general the roots of the shallow set are finer than the roots of the deep set.

Root variations under different soils.—Nitrate fertilisers lessen root penetration but greatly increase branching. Potassium salts and phosphates, on the other hand, greatly promote root extent. When liberally fertilized with these salts, plants in moist soil make a vigorous growth both above and underground, the roots extending farther into the substratum. For example, at Rothamsted, England, in a very shallow, heavy clay soil in poor tilth, with a compact clayey subsoil, the roots of barley plants were confined to the top 2 inches, and none were found below 6 inches. Deficient aeration was indicated by the decay of some of the roots. But when super-phosphate was used, the roots went somewhat deeper, and in the plots treated with farmyard manure, a depth of 9″ was attained.

Barley, when grown in rich deep soil, has a root habit very similar to that of wheat and oats; the fineness of the roots, degree of branching, and lateral spread often being intermediate. Barley roots often occur nearer the surface than those of wheat or oats. The root system is very plastic, and where dry soil prevents normal penetration, lateral spread and degree of branching are greatly emphasized. Poorly aerated, heavy clay soils may cause

the roots to be very superficial. Addition of fertilisers promotes root development.

The barley is grouped under different varieties according to the rows of the spikelets in the spikes:—

(1) The six-rowed barley
(2) The two rowed barley
(3) The four-rowed barley.

In the typical six-rowed barley, there are three fertile spikelets at each node, and all lemmas bear awns or hoods; two-rowed barley has the usual three spikelets at a node but the outer spikelets are sterile, hence only two-rows of grain-bearing flowers occur. There are also four-rowed barleys which are variously produced.

The barley may also be divided into groups according to awns:—

(1) Awned barley
(2) Awnless barley
(3) Hooded barley which bears a curious structure, the hood, at the tip of the lemma.

The barley may be hulled or hull-less (naked). In hulled barleys the palet and lemma are firmly attached to the kernal. In the so-called "naked" or hull-less barley, these scales come away from the kernal in threshing. In the mature grain of barley, the embryo is small, as in other cereal grains; the aleurone layer is composed of two to four rows of cells; gluten is absent.

Inflorescence and structure of a complete flower of barley :—The inflorescence is a spike, the rachis straight, not zig-zag as in wheat. At each joint of the rachis, there are three spikelets, each one flowered. The three pairs of glumes at a node are narrow and appear as short awns, while the true awn of the lemma (in bearded vartieties) is very long and much stiffer.

The complete flower in barley is composed of three anthers, an ovary with two brush-like stigmas, and two thin bodies, the lodicules, situated on either side of the ovary.

Isolation of pure types of barley :—The country barley is generally a mixture of various unit species and can be improved by selection as regards yielding capacity, standing power, disease resistance and time of maturity. In order to obtain some improved strains, a collection of samples from important barley-growing districts was made by the Botanical Section at Pusa about sixteen years ago. From this collection twenty-four unit species have been isolated and some of these have proved very superior to the average mixed crop.

Scheme of classification :—Barley belongs to the genus *Hordeum* in the natural order *Graminae*. Hackel divided this genus into three sub-genera and each subgenus, into species; all the cultivated barleys falling into one subspecies *Sativum*. The genus *Hordeum* is distinguished among others of the grass family by the presence of one floret only in each spikelet. Wheat usually has three and oat two florets in each spikelet. The single-flowered spikelets are arranged in threes on alternate sides of the rachis. When all these are fertile, developing six vertical rows of grain, the variety is known as a six-rowed barley. If the lateral spikelets are sterile, and only the middle row is fertile, the variety is known as a two-rowed barley. In India the commonly cultivated form is the six-rowed barley.

Linnaeus (1748), the founder of systematic botany, divided the cultivated barleys into *Hordeum hexastichon, H. vulgare, H. zeocriton, and H. distichon.* He based his classification upon fertility, density and the adherence of the flowering paleae to the kernel.

In 1918 Harlan brought out his paper "The Identificatin of Varieties of Barley." His key to species is :—

Key to species

All spikelets fertile (6-rowed barley).

Lemmas of all florats awned or hooded ... ... *vulgare L.*

Lemmas of lateral florets bearing neither awns nor hoods ... *intermedium, keke.*

Only the central spikelets fertile (2-rowed), Lateral spikelets consisting of outer glumes, lemma, palet, rachilla and usually rudiments of the sexual organs ... ... *distichon L.*

Lateral spikelets reduced, usually to only the outer glumes and rachilla, rarely more than one flowering glume present, andnever rudiments of sexual organs ... ... *deficiens, Stend.*

These four species of barley are divided into 32 varieties by Harlan. These varities are further sub-divided into a number of sub-varieties. This system of classification advocated by Harlan may be considered ideal for barley,

Distinguishing characters of barley :—Barley plants bear a strong resemblance to wheat and oats. Even at a very early stage of its development, however, it can be readily distinguished by its habits of growth and the character of ligule and auricles.

Character	Oats	Wheat	Barley
1. Early habit ..	Erect or semi-erect	Semi-erect ..	Erect with leaves usually curled on themselves.
2. Ligule ..	Well developed and has a number of small teeth.	Developed, but more or less blunt.	Developed but blunt.
3. Auricles ..	Absent ..	Developel and hairy.	Well developed but glabrous.

The cultivated barley in India is generally tho hulled six-rowed form. Rarely the six-rowed hull-less form, such as the *Pusa Ramdana* variety (Type 24) is grown in some parts of India, but as the average yield is somewhat lower it is never grown on a large scale. Two-rowed barleys, both hulled and hull-less, are grown to a very limited extent.

Before a detailed classification of any crop can be attempted a thorough knowledge of its important characters must be made. The characters observed in isolating the twenty-four types of barley are divided into:—

(*a*) Morphological.

(*b*) Agricultural.

(*a*) *Morphological characters*:—This group of characters is mostly confined to the morphology of the floral parts and they are more or less constant:—

(1) Fertility.
(2) Characters of tho hull.
(3) Terminal appendages of the lemma.
(4) Colour of the spikelet.
(5) Leaf sheath colour.
(6) Density—Density is taken to mean the number of spikelets per unit length of rachis generally 10 cm.
(7) Outer glumes.
(8) Rachilla.

(*b*) *Agricultural chracters.*

(1) Root system.
(2) Early habit.
(3) Tillering.
(4) Lodging.
(5) Foliage.
(6) Height.
(7) Size of grain.

(8) Maturity.

(9) *Bushel weights.*—The weight per bushel is one of the main criteria of the commercial quality of many crops.

(10) *Nitrogen content.*—The nitrogen content of the barley grain is the surest guide to malting quality.

(11) Diseases.

Varieties:—There are twenty-four different types. Out of these, five are two-rowed barleys and the rest are six-rowed barleys. All the two-rowed barleys except Type No. 1 are late maturing. The Type No. 1 matures in sixty-five days only.

Type 12 :—Tillering good, early habit erect, density 23.2; kernel hulled, weight of 1000 grains 38 gms., bushel weight 48 lbs., maturity early (71 days); a high yielding type

Type 20 :—Early habit erect, tillering good, kernel hulled, density 22.5, weight of of 1000 grains 40.3 gms. Bushel weight 47 lbs.; maturity early (72 days); a high yielding type with very long ears.

Type 21 :—Early habit, semi-erect, leaf sheath, colour green, tillering good; density 30.2; kernel hulled, long, and plump, white with a purplish tinge, weight of 1000 grains 38. 1 gms.; bushel weight 45 lbs.; maturity early (72 days). This is the best yielder under North Indian conditions. Glume and awns purple, fading to lighter shades on ripening. (Previously called B-4).

Type 14 :—Is the earlest maturing barley (61 days).

Yields of different types:—In 1929-30, Type 21 produced an outturn of 2570 lbs. to the acre in Botanical section Pusa. The following yields were obtained at the Government Farms, Shahjahanpur, U. P.:—

Types	*Yield in lb. per acre.*
Type 21 (B-4)	2,755
Type 12 (B-22)	2,807
Type 20 (B-23)	2,651

The Dholi concern in the Muzaffarpur District, Bihar has obtained a yield of 3,845 lbs. to the acre with type 21, from an area of 0.25 acres, while the Model Farm at Beawar (Rajputana) has also secured an outturn of 2,152 lbs. to the acre with the same type. The increased outturn of Pusa barley, specially of type 21 will be of great value to the ryot.

Much work on barley has also been done at Cawnpore Agriculture College. C.251 is a very good yielder. Its value has been fully established for export, and for growth on good barley soils. Its multiplication for wide issue is being undertaken. C.251 and C.255 are gaining popularity in the Agra Division.

The ratio of grain weight to straw weight generally depends on the type itself and in the high yielding types the straw weight is approximately $1\frac{1}{2}$ times the grain weight.

Diseases of barley :—The following diseases do a great harm to barley crop:—

Smuts:—(1) Covered smut—(Ustilago Hordei)

This disease is found all over northern India.

The life history is similar to that of oat smut, infection taking place in the seedling stage and the fungus growing up inside the plant until the inflorescence appears when spore formation begins.

Treatment:—(*a*) The most convenient treatment is the formalin treatment.

(*b*) *Hot water treatment*:—It consists in dipping the grain in water at 132° or 133° F for 10 minutes. It is advantageous to warm up the mass of grain first, by dipping the sacks or baskets in which it is contained into warm water at say 110° to 120° F. for a few minutes before transferring to the hotter bath. A thermometer must be used. The grain should be stirred about, or if in a sack, lifted out, allowed to drain and plunged back several times, to secure even heating. Properly carried out the crop may be entirely freed from smut, all the spores being killed.

(c) *K_2S is also used in some countries.* The grain is immersed in a solution of one pound K_2S to 13 gallons of water for 24 hours. Copper sulphte is less satisfactory.

(2) Loose smut (Ustilago nuda)

This is much rarer than the covered smuts in India. The hot water treatment is the most frequently used. The seed for the seed-plot should be first soaked for 4 to 6 hours in water at about 68° to 86° F. then placed in small sacks or baskets and immersed in water at 129° F. for 10 minutes. A temperature below 124°F. is ineffective, even if a longer treatment is given. It should then be well dried and sown soon to avoid mouldiness or deterioration. Since even good seed has from 6 to 10% of grains injured by heat, it is necessary to increase the sowing rate.

Rusts:—

(1) Dwarf rust:—(Puccinia simplex.)

(2) Black rust:—Puccinia graminis.

(3) Yellow rust:—Puccinia glumarum.

Dwarf rust is less common than the others in India.

Stripe disease:—(Helminthosporium gramineum.)

In England, it is sometimes called "blindness" or "deaf ear," one of the most marked symptoms being the failure of the ear to set its grain properly.

Important symptoms :—(1) It begins by the appearance of small, pallid spots on the leaves and sheath.

(2) The grain does not mature properly.

(3) The leaves often split or shred, and wither early; every shoot of the stool is usually affected.

The treatment is, therefore, similar to that of covered smut or the smut of oats. The best results have been obtained in some cases with formalin with an increase of 25% noted. With copper sulphate, it has also been prevented, but the germination of the treated grain was reduced by about 15%. The hot water treatment is recommended where naked smut is also present, as it is the only treatment that checks both diseases.

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TEN MARKS OF AN EDUCATED MAN

Albert Edward Wiggam.

(1) He keeps his mind open on every question until all the evidence is in.

(2) He always listens to the man who knows.

(3) He never laughs at new ideas.

(4) He cross-examines his day-dreams.

(5) He knows his strong point, and plays it.

(6) He knows the value of good habits and how to form them.

(7) He knows when not to think and when to call in an expert to think for him.

(8) Yocan't sell him magic.

(9) He lives the forward-looking, outward-looking life.

(10) He cultivates a love for the beautiful.

AGRICULTURAL PROPAGANDA

N. S. KULANDAISWAMI PILLAI

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Of all the provinces in India, Madras is mainly agricultural. The total population of the Madras Presidency is estimated at 48.64 millions in 1935 of which 71% live by agriculture. An analysis of the population living by agriculture reveals that 45% form agricultural labourers, 39% cultivating owners, 12% cultivating tenants, $3\frac{1}{2}$% non-cultivating owners and $1\frac{1}{2}$% non-cultivating tenants.

The total area under cultivation is about 34 million acres which works out to less than 0·75 of an acre per head of population. Thus the pressure of population on the soil is very great. It has increased since 1914-15 when it was estimated to be just under 1 acre per head.

This large population depending on agriculture is scattered over innumerable villages, the majority of which are accessible only to slow moving country carts even in the best of weather conditions. When rains set in, a still greater number become inaccessible to all except pedestrians.

The villagers themselves are poor, uneducated, ignorant, superstitious, heavily indebted and with a low standard of life. The enervating climate, the treacherous seasons, the social and religious customs, the scattered, sub-divided and uneconomic holdings, lack of capital and the poor cattle, all tend to retard the development of agriculture in the country and make it a losing business concern.

Of late the ryot is awakening to a sense of his position. This is the silver lining to the clouded sky; for this will lead to his redemption in a measurable distance of time.

It is to bring the resources of science to bear upon agricultural problems and spread the knowledge obtained thereby to the ryots and thus better their lot, that agricultural departments were established in India. Prior to 1905 there were no organised attempts at agricultural improvement by Government. Since then they are increasingly recognising their responsibilities in the matter and are taking steps to discharge them.

Greater and greater attention is being paid to agricultural research. Without research, agricultural development will be at a stand-still. When research attains a certain stage, propaganda should be simultaneously carried on to spread that knowledge to the farmers. Propaganda forms therefore a complement to agricultural research; without propaganda, research will be of little use.

In the early days of the department when there were only a few workers and research was just in its infancy, there was not much scope for propaganda. The work of the department as described by Mr. Mackenna may be summarised as follows:—

"The problem which the Department sets itself is the improvement of Indian agriculture. The basis of all progress is research. The results of research are then tested on a field scale. When the experiment is proved, the stage of demonstration is reached. All the experimental work must be done by the Department and its results offered for application in a cheap and simple way.

" It is obvious that if results of a practical value are to be obtained the agricultural worker must have a thorough knowledge of Indian agriculture and sympathetic feeling towards the people. Above all he must go slow."

He realised that "to influence to any extent the vast agriculture some arrangement must be devised to deal with large bodies of cultivators as it is an economy of time to deal with a group of people rather than to deal with single individuals." He expected this to be carried

out through the simultaneous development of the Co-operative movement.

After the lapse of more than two decades most of these expectations remain yet to be realised. After all these years of travail, even the credit movement, which is considered to have succeeded most, has not touched more than 6% of the population.

We have now come to a stage when we have some data which will help the farmer if he is made to understand them and induced to take them up. We have tried our best to make the fullest use of the co-operative movement to do our propaganda work. Standing on this same platform nearly a decade ago, I narrated how my attempts to induce members of co-operative credit societies to adopt improved methods of agriculture failed and how I started special co-operative societies with the object of spreading improved methods of agriculture and explained the progress then made by them. I then expected them to progress considerably better than they have done so far and hoped to start and run successfully more such societies. The unfavourable season for a number of years, the economic depression and above all want of incentive stood in the way of further development along that line.

To overcome these difficulties I started village, firka, taluk and district agricultural associations. Many of these are now moribund. They do not rest on self-help. Hence they do not function if the demonstrator is unable to look after every detail of their working. The intensive drive of mass propaganda inaugurated by our former director, Mr. S. V. Ramamurthy gives the demonstrators no time now to attend to such details of work. I am yet to hear that any similar movement has succeeded anywhere on a large scale in this Presidency.

Under such circumstances the traditional method of tackling individual ryots by the Department is more the rule than the exception. This is very laborious and still is in the nature of ploughing the sands. As one who has

himself been a demonstrator, I know the difficulties experienced in carrying on the work along the present lines. The demonstrator with great difficulty has to pitch upon a few ryots in a village to try the improvements recommended by the Department. When he visits the village next he hears that one of them has gone to a neighbouring village, the whereabouts of another is not known, a third is busy otherwise and so on and so forth. A few go on eternally discussing the improvements suggested, but never agree to work out even one of them practically for trial. Hours, days and months are thus spent by the demonstrator without any appreciable effect. I often doubt if even centuries of ill-directed efforts like these will ever bring about the desired improvements. The concentration method adopted during recent years which has prevented the demonstrator from wandering aimlessly throughout his jurisdiction is just a step further in the right direction; but it will not take us far. Attending 8 to 10 centres involving 40 to 50 villages is a task beyond the capacity of a single demonstrator. In deltaic areas and on the banks of rivers the villages are close together and their total area is small, while in other tracts the villages are far apart and large areas have to be dealt with. This is due to the fact that Government has based the size of villages and taluks on the amount of revenue fetched by them. In such cases it is desirable that, in addition to the demonstrator at the taluk headquarters, every Deputy Tahsildar's division be provided with an additional demonstrator, and each demonstrator be assisted by an adequate staff of maistries. Above all, there should be some organised bodies to help the demonstrator in his propaganda work.

A former Director of Agriculture in France pointed out the difficulty of dealing with individual farmers in the following words:—

"It is impossible for a Government to influence millions of petty peasants; they are individually too isolated, too suspicious, too shy to accept new ideas to undertake experiments in new methods; similarly they are

too poor, too powerless to produce the best products to get the better of the middlemen, and the best of the markets."

He pointed out that "there must be some organisation which enables Government to act upon a body of men at once and to serve as intermediary between the Government and the individual. An organisation which can be advised, educated, reasoned with, and listened to, and which will discuss together the suggestions of authority and will through its better educated and bolder members provide intelligence to absorb new ideas, find courage and funds to attempt new methods and combine both for the improvement of products and for the better sale of the same."

Realising as we do the serious drawbacks of dealing with individual ryots it is incumbent upon us to discover fresh avenues which will result in leading us to better success.

A study of the methods successfully adopted by other people placed under similar circumstances may perhaps give us clues for solving our own problems; for human nature is the same all the world over.

The Japanese for example have solved their agricultural problem by imparting education, both general and agricultural, and also by the establishment of various types of agricultural associations. In his note on agriculture in Japan, Sir F. A. Nicholson observes that "the development of general education has been at the root of much of the national progress and has affected and will in the near future most powerfully affect the progress both of the technique of agriculture and the agriculturist."

Higher elementary schools with an agricultural bias, supplementary schools to supplement the work of the elementary schools, regular agricultural schools of lower and higher grades and agricultural colleges lead the boys from one stage to another according to their capacity, wealth etc. There are thousands of such institutions spread throughout the length and breadth of the country and thousands of pupils are trained in them.

Writing about agricultural associations the same author observed, "These are among the most remarkable evidences and are becoming most powerful instruments of agricultural progress in the country. Practically the whole agricultural population of Japan is united in various forms of associations; probably there is no country in the world, not even Germany, where the associations have taken such hold and are beginning to exert such influence."

All these were prior to 1906. During the succeeding three decades the great strides made by this country in developing its agriculture, have converted it from a food-importing country to a food-exporting country, in spite of the rapid increase in its population.

The rural districts of Denmark as late as 1880-90 had been in a bad way and the people were leaving the country parts for the towns. At the present time all authorities bear witness to the general well-being and contentment of rural Denmark. A three-fold development was at the root of the progress : (1) economic reforms, (2) machinery for rural development, and (3) technical advance on scientific lines. The economic reforms have been conducive to the formation and maintenance of small farms and state laws have been in the interests of the small farmers who now form their country's pride. The machinery for rural development consists of arrangements for rural and agricultural education and co-operation. Both agricultural schools and cooperative societies were started as private ventures. Scientific dairying has been fully developed on modern lines.

Coming nearer home to the premier state of Mysore, it may be noted that it passed a village Panchayat Act during 1926 and gave effect to it in 1927. "The Act recognized the backwardness and the diseased state of social conditions in rural areas and felt that unless some external support and schooling were given, the village panchayat may not come to possess local foundation at all." Now the village panchayats have some obligatory

functions, like village communication, sanitation and also certain discretionary duties, such as vaccination, economic improvement and delegated duties including the control of the village forests, tanks, and local religious institutions. The responsibility of supervising the working of the panchayats is vested in the executive head of the district who is assisted by Inspectors of Panchayats, and the whole system is co-ordinated and controlled by the Registrar of Panchayats.

From a recent notification of the Government of Mysore, which appeared in the HINDU of May 12th, it is found that an intensive programme of rural reconstruction is being taken up through the village panchayats. More than 11,000 village panchayats have been constituted to administer local affairs in rural areas. The progress achieved during the nine years the Act has worked, is remarkable. More than 30 per cent of the panchayats are said to function very efficiently.

The Government Order states that "it is felt, however, that the time has arrived to make more intensive efforts in at least some selected villages, of each district so that these villages may eventually serve as examples of good panchayat administration which less advanced ones may be induced to follow.

"At the same time it is desirable that the Development Departments concerned with rural welfare should also concentrate on propaganda and administration work in the selected villages so far as this can be done without prejudice to their normal activities. This will not only help the officers of these departments to aim at and achieve speedy and tangible results in definite areas, but will also enlarge the scope of the work of the panchayats".

With the above object in view, the Government have issued the following instructions:—

"(1) In each Revenue sub-division about 8 or 10 villages should be selected for special attention by the officers of the Revenue and other Departments, namely Education, Health, Agriculture, Industries and Commerce

and Co-operation; (2) only those villages need be selected in which panchayats possess adequate income and are working fairly satisfactorily; (3) the items of work to be adopted should be clear in each case with reference to the needs of the locality, the facilities already existing therein and the funds available for the purpose.

"The development of selected villages will be a special responsibility of the head of the district, subject to the instructions of the Revenue Commissioner and the Government and the advice of the Development Departments concerned. In order to assist the Deputy Commissioner in the work, an advisory committee consisting of the Revenue Sub-divisional Officer (as organiser and convener) and the local officers of the several development departments in the district, may be constituted. The members of the Committee will arrange to tour the village once a quarter and review the progress of work made and settle the lines of future work.

"The subjects for special study in the selected villages will be among others (*a*) raising the standard of village panchayats administration; (*b*) propaganda of better farming methods including the supply of good seed; (*c*) rural credit; and (*d*) marketing of commercial crops".

I have quoted this at some length as I want to suggest the adoption of a similar method, modified if necessary to suit our conditions, to gain our ends.

The object of the Department should be to gradually shift the work of Agricultural Development from the shoulders of Government to those of the people themselves, recognising that it is not that which is done for the people but that which is done by the people that is truly beneficial, and that real progress can come only from within; this transference of work is impossible unless there are popular bodies to take up the work.

These popular bodies may be agricultural associations as in the case of Japan; co-operative societies as in the case of Denmark; or village panchayats as contemplated in Mysore. As the former two have not succeeded

so far, in spite of the best attempts of the Department, statutory bodies like the village panchayats may be brought into existence in large numbers throughout the length and breadth of the country.

We have our own village panchayats in the Madras Presidency but fresh life should be infused into them and they should be established in every village as quickly as possible. Their duties and responsibilities should be widened according to their capacity to bear the burden. At present their duties are confined to improving the village sanitation, health and education. It would appear that no serious attempt has been made to introduce agricultural improvements in the functions of the village panchayats. Unless the material prosperity of a village is improved, the realisation of other improvements, sanitation, and health is bound to be very slow. The primary source for the material prosperity is increased out-turn from land, and this can be obtained through the adoption of improved methods of agriculture. Therefore the rapid spread of agricultural improvements should be the statutory obligation of village panchayats.

The time seems to be propitious. There is a very large mass of educated unemployed who can be pressed into the service of these panchayats on nominal salaries. Knowing as we do the competition existing among them, even for posts of attenders, there need not be any apprehension with regard to securing their talents at a price the country can afford to pay at present for the purpose. The cheap and healthy village life and the opportunity of being pioneers in the line will induce them to work whole-heartedly any scheme launched by Government to gain the end in view.

To secure the cooperation of the villagers themselves in the working of any scheme that may be launched, some element of compulsion may be necessary.

As one Indian economist observes "a truth of supreme importance which all should bear in mind at the present moment is that no Government in India can give any effective help for the betterment of rural condi-

tions by measures which do not contemplate the cooperation of villagers themselves. Another truth of equal importance is that at present the individualistic spirit which has basked under the British flag for decades together will not permit even the out of the way villager to heartily cooperate with Government agencies in rebuilding rural structures."

An enlightened Government must force at some stage the unwilling patient to swallow the (bitter) pill. In India cooperation by the people in rural economic development must be made compulsory by law.

In numerous directions we want improvements. Government alone cannot hope to bring them about; people by themselves, have no means, no enlightenment, no eagerness for the common good. To bring about consolidation of farms, redemption of agricultural land from oppressive debt, freedom from unemployment and scarcity of labour and many other economic reforms, the British Indian legislatures and the authorities in Indian states must have recourse to compulsion as the timely expedient; there is no other method of belling the cat.

We have now a sympathetic agricultural Viceroy who is all for action. The Central Government's rural grants have been increased and we expect it to become a regular feature in years yet to come. The whole of thinking India is interested in rural development. Our educational system and programme are about to be reorganised. It is said that the Central Government is in consultation with the Local Governments about the appointment of an expert committee to go into the whole question of educational reform. It is hoped that realising the position and importance of agriculture to the country, a definite bias will be given to agriculture at every stage in the curriculum; and not be content with having rural education, general and agricultural education, technical.

We are about to enter the stage of provincial autonomy with prospects of having federation at the top of

it within a few years. Without the reform of the man at the plough brought about by the initiative and coopertion of village panchayats and liberal support of the Government, the new era may yet see us far away from the millenium which it is expected to usher in.

Soils, rainfall, and agricultural practices vary widely from district to district and often between different places in the same district. In order to increase the opportunities for research, to enable science to solve the peculiar agricultural problems of each district and to act as the local store house of all agricultural development and propaganda, it is essential that there should be one or more agricultural farms in each district. Such farms may be run wherever practicable by the local village panchayats, cooperative societies or agricultural associations.

The possibilities of carrying home the latest developments in agriculture to the minds of young and old through movies and talkies should be explored and utilised.

In carrying on agricultural propaganda one cannot afford to neglect the new vista of development opened up by broadcasting. Western countries true to their traditions have already made rapid strides in this line. Already some of our sister provinces like the Punjab are leading in this matter. When the village panchayats come to function all over the Presidency broadcasting will have to be increasingly resorted to, to educate the ryot.

If I supply you a thought you may remember it and you may not. But if I can make you think a thought for yourself, I have indeed added to your stature.

—ELBERT HUBBARD.

MANURES AND FERTILIZERS

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It has often been said by agriculturists and investigators that the Indian soils have deteriorated much in their fertility. The Agricultural Adviser to the Government of India made the following statement before the Royal Commission on Agriculture in India, 1927-28, "Most of the area under cultivation in India has been under cultivation for hundreds of years, and had reached its state of maximum impoverishment many years ago." This is well evidenced by the low figures of production per acre in India, in spite of all her natural resources and other facilities. There has not been so far any satisfactory general investigation on this problem as to which tracts of Indian soils lack in certain fertilising elements, and no reliable statistical data about it is available. The only accomplishments up till now are a few poorly carried out experiments of some agricultural colleges and experimental farms. In most cases opinions have been expressed on the basis of low yields obtained.

Survey of Indian Soil Conditions. However, it has been unanimously agreed that all Indian soils lack in nitrogen and the work done at Pusa shows that 60 to 150 lbs. of nitric nitrogen per acre per annum and that at Nagpur shows that as much as 160 lbs. of nitric nitrogen per acre per annum, are lost from cultivated fallow lands, and the most severe loss in the year occurs during the monsoon by drainage and leaching. The loss of nitrogen through continuous croppings (followed by no nitrogen addition) and partly through denitrification have increased the soil exhaustion a great deal. But on the other hand all Indian soils are tolerably rich in potassium. The soils of Bihar, Orissa, Bengal, Assam, Burma and Deccan are very poor in phosphoric

acid, but further west in the United Provinces, the Punjab, Rajputana, Central Provinces, Bombay, Madras and the South the shortage of phosphoric acid is not so acute. Besides these the laterite soils of Central and South India lack considerably in lime and are acidic in nature.

From this elementary survey of Indian soils it is clear that these soils are deficient mainly in nitrogen and phosphorus which are of basic importance for plant growth and therefore essential for soil fertility. Besides these, the soils also lack in humus content and some other elements of minor importance. Therefore the problem before us is how to meet these deficiencies of the Indian soils through the application of manures and fertilisers.

Literally manures and fertilizers are synonymous, and are generally understood as the materials which improve a soil for the purpose of growing of crops. But they are technically differentiated as manure refers to bulky materials, generally made from the farm refuses and by products, by careful handling alone, while fertiliser refers to artificial or commercial fertilisers that have been chemically prepared (or sometimes may be found naturally as raw rock phosphate) and are much lighter in form, are effective much more quickly than manure, and are usually commodities of extensive commerce. Besides these technical differences there are also certain functional ones, as the manure in addition to giving nitrogen, phosphorus and potassium, that are also usually supplied by fertilisers, supplies humus (the organic matter in the soil, the decayed and partly decayed tissue, having lost its vegetable structure and having become a dark amorphous mass) and to some extent many other elements such as calcium, magnesium, iron, sulphur etc. The manures in general may be classified into three classes.

1. The bulky and slow-acting ones include dung of live-stock of various kinds, which when mixed with straw etc. is known as farmyard manure; compost which is a product of the decomposition of all sorts of vegetable waste; and green manures which are actual crops grown

specially to be ploughed under and mixed into the soil. These all consist of a large bulk of more or less rotted vegetable matter containing comparatively small quantities of actual plant foods but including minute quantities of most of the elements a plant requires. Largely these are the manures that determine the humus content of the soil.

2. The second group includes such manures as oil-cakes, bonemeals etc., that are rather more concentrated and quicker acting but still are of organic nature.

3. The third class includes the most concentrated manures or fertilisers as previously termed, that carry the actual plant foods, *i.e.* nitrogen, phosphoric acid and potash but no organic matter. In addition to this, some special fertilisers such as lime and gypsum are used to sweeten soils that are excessively acidic and unfavourable for certain plants' growth.

Scope of these Manures and Fertilisers in India. Though the needs of the Indian soils, as expressed in the very outset, have been long felt and have been seriously considered, not much success has been attained in filling them. The main stumbling block has been the well known poverty of Indian cultivators, and secondly their ignorance. These two together make the applications of the third class of manures, *i.e.* fertilisers practically impossible by the Indian peasants. Chemical fertilisers are generally costly, and often require cash money for their purchase. Sometimes farmers have tested the use of these fertiliser by providing themselves with borrowed money, and at the end have found themselves in actual losses because the rates of interest being very high, the cost, (actual cost plus the interest during the waiting period) exceeded the income gained by the extra yield due to the use of fertilisers. Though this may not be universally true, it has limited the application of fertiliser in India to a great extent. The ignorance of the farmers has also played an important part. They do not know (*i*) the methods of application of different kinds of fertilisers, (*ii*) the after

effects of a long continuous application of a certain fertiliser, (*iii*) the actual needs of different fields and the respective proportions of elements necessary to constitute the complete fertiliser.

The extensive use of fertilisers by Indian cultivators is possible only if their sale be taken up on credit either by co-operative credit societies or agricultural departments and if the cultivators are instructed about the methods, time and quantity of application.

But chemical fertilisers are not the only means of soil-recuperation. This can be well done by internal sources of supply from the farm by-products alone by means of farmyard manure, compost etc., and certain extremely cheap oil cakes such as *mahua* and castor oil cakes. In these sources also the Indian cultivators have been handicapped by poverty and ignorance to some extent, but by carelessness to a greater extent. To persuade the Indian farmers to apply farmyard manure to the soil instead of burning it is almost impossible because their essential problem of daily fuel is solved by their farm animal dung cakes, and certain crop stocks such as arhar, cotton etc. "This view has been truly held that it is the absence of a sufficient supply of firewood which, over large parts of India, compels the burning of cow-dung as fuel" (Howard). But in some places like Burma and Deccan where sufficient firewood is available, people still use dung-fuel because the Indian housewife prefers it due to its slow-burning nature. However, it is very unfortunate for Indian farmers not to have sufficient firewood, and our evidence also does not suggest any alternative fuel for domestic purposes in districts where wood and coal are scarce and expensive. Mr. Howard also remarks that "the agricultural departments have a difficult task to perform in attempting to promote the utilisation of farmyard manure for its proper use. Propaganda in this direction can only be effective if an alternative fuel is suggested and if the cultivator can be sufficiently imbued with a sense of thrift to induce him to burn that which will probably seem to him

a less useful substance." I think it will be more paying if only woody stalks from the farm as arhar, cotton, jute, castor plant be sufficiently grown for use as fuel so that cow-dung may be saved for farmyard manure. The useless and small unproductive patches of farmland may be planted to some suitable perennial firewood plants that may constitute a part of the alternative fuel.

But so far as litter provision for cattle and wastage of liquid manure is concerned, the Indian farmer is to be blamed partly due to his carelessness and partly to his ignorance. Propaganda on this point is sure to be effective, because it falls within the easy reach of the farmer and requires only a little care and labour. This liquid part of farm manure is the best and richest for available nitrogen supply. The litter provision can be well met by the several farm straws like rice, *sawan*, *kodon*, *urad*, and *mung* straws, fodder wastages and muck soil etc., and the cattle urine will be well preserved.

The farmer is ignorant about composting but it is very practicable as it requires no expense except labour, because the farmer can utilise all the waste vegetable materials, sweepings, leaves etc., in this way very profitably with only a little care and labour. Besides this if all farmers adopt this practice their villages and surroundings will be much more healthful. At this point, Indian cultivators have much to learn from Chinese and Japanese farmers, because they are so keen and careful that all the organic and vegetable refuse finds its way to composts, which renew soil fertility on application.

So far as green-manuring is concerned it has a very wide scope and it has been practised very widely in many places. It should now be universally adopted and be made a regular part of crop-rotation schemes. The use of legume crops for green-manuring is always preferable, and in India sann hemp and *dhaincha* are suitable for this because they can be grown almost anywhere and have quick-growing and nodule-forming characteristics.

The application of oil cakes as manure in India is very limited, because most of the oilseeds are exported,

and the small proportion that is crushed here gives a small amount of cakes, usually too dear to buy to be used for manures. On the other hand they form the main concentrate feed for cattle in India. But certain oil cakes as *mahua*, *neem* and castor cakes can be had very cheaply and can thus be used most profitably.

Some Available Manures and Fertilisers and How to Use Them :—*Farmyard Manure*. Farmyard manure is the best-known bulky manure. It consists of partially decomposed mixtures of dung and urine of various farm animals, cows, buffaloes, ponies, goats, sheep etc., with waste fodder materials and straw or plant residues. As already pointed out there is very little possibility of sparing dung of cows and buffaloes for manuring, due to having no alternative fuel. But, however, a little can be spared and may be best utilised as follows:

Near the cattlesheds a shallow pit should be made in which at the bottom a certain amount of plant refuse is put in order to prevent the loss of the liquid portion of the manure by leaching. If convenient, the urine should be directly drained into the pit or litter of straw, fodder refuse, vegetable residues, saw dust or air-dried muck and peat soils or ash may be provided in the barn to absorb all the liquid manure, and later on be piled in the pit. To get these fully mixed and rotted the manure must be left in the pit over a rainy season. Care must be taken to keep the heap compact and moist to avoid the loss of nitrogen as free NH^3. The addition of peat litters helps is nitrogen-saving a great deal. If possible gypsum or superphosphate may be added for best results. When well rotted all the weed seeds and disease organisms are killed and the manure is safe for use.

Such farmyard manure contains 0.4 to .5 per cent nitrogen, 0.3 per cent phosphoric acid and .2 per cent of potash, and to some extent various other plant foods. In average soils its application at the rate of 300 to 400 maunds per acre will give satisfactory results. Its effect on the soil is slow but long lasting. Its addition of considerable humus to the soil is very beneficial, because

it provides a suitable medium for the bacteria and micro-organisms (especially nitrogen fixing organisms) to develop and has a cohesive effect on sandy soils and a loosening effect on clays, and increases the water and heat absorbing powers of the soil a great deal.

Compost. Considering the impracticability of the extensive use of farmyard manure, compost appears to be an excellent substitute, because it requires nothing but simply a collection of all farm refuse, leaves of trees and shrubs, sugarcane trash, spoiled straw and grass and other surplus vegetable materials and sweepings and a little care.

In England this is practised by the Adco method but in India the Indore process developed by Howard, is most practicable. In conditions where a moisture supply is available, the Indore process says, to collect all the aforesaid possible vegetable materials and heap them into a pile twenty feet long, ten feet wide and four feet high. If more materials are available the length may be increased. Then give a few doses of dung and urine to inoculate this heap with the bacteria and necessary fungi for rapid decomposition. By periodic waterings and turnings (say fortnightly or so) of the heap, the proper temperature for best growth of these bacteria may be had. Care must be taken to avoid losses through leaching. Sometimes sann hemp seeds are sown on the heap of trash and turned under when two to three feet high during the monsoon. Very satisfactory results are obtained in this way. With sufficient care the material all decomposes within three to four and one-half months to a friable black powdery leaf-like mould and is an excellent compost.

In places where a regular supply of water is not available, the heap should be collected during the dry season, and during the rains it should be exposed to the weather, and should be turned and stirred periodically as in the previous case. This stirring-interval may be regulated by the amount of rain falling. In heavy rains the interval should be longer and in light rains the

interval should be shorter, the whole object being to get sufficient moisture well distributed throughout the heap. Each turning lets air into the mass, and spreads the moisture and the colonies of decomposing organisms through the heap so that rapid decomposition results. In rapid decomposition the temperature rises up very high 110° to 120°F and most of the weed seeds and disease organisms are destroyed thereby. This process is called "Rain-Water Composting" and is more practicable for the Indian cultivators than the previous method.

The final product, compost, is a dark brown or black friable powder. It contains as much as 5 p. c. nitrogen, but less potash and phosphorus. It is much quicker in action than farmyard manure. For balanced manuring a dressing of compost should be supplemented with the addition of a little fertiliser. Compost alone is applied from 350 to 450 maunds per acre in ordinary soils. It is applied during the seed bed preparations. Its considerable humus content necessitates its use in large quantities.

Green Manure. The use of green manuring in India has been an ancient practice but the misfortune lies in its too limited application due to the negligence of the farmers. Those farmers who practice it do not get all the possible benefits because of not having suitable implements to chop and bury the plants in the soil. As already mentioned, a quick growing legume crop is always preferable for green manuring. Here in India experiments with sann hemp (*Crotalaria juncea*), and *dhaincha* (*Sesbanea aculeata*) have been proved very successful. These are grown in all parts of India. Besides these *methi* (*Phaseolus Ricciardianuis*), and cowpeas (*Vigna catjang*) may also be used satisfactorily. Any of these are cheap and easy to grow. A green manure of any other crop such as mustard, rye etc., is not profitable as it does not fix any nitrogen in the soil.

In well drained soils sann hemp and in wet soils *dhaincha* should be grown early in the monsoon and

within 6 to 8 weeks an ample bulk of vegetable matter will be ready to be turned under. The best way, before turning under, is to get the plants chopped in the field by using a disc harrow, but since it is not available to the present cultivating masses, a patela or drag should be passed over the standing crops to beat the plants down. Then the plants should be turned under either by dragging or ploughing with a mould board plough. After being turned under it should get at least one month of rain. For the rabi season a green manure should be sown by the middle of June and ploughed under by early August.

Clarke (1930) at Shahjahanpur found that in the U. P. a properly grown sann hemp crop as a green manure adds 60 to 80 maunds of nitrogen per acre to the soil. It adds nearly all plant foods to the soil. Some people neglect it as it results in the loss of a kharif crop but this is unreasonable because nobody plants a kharif crop in all his fields in India. The fallow field for rabi and other money crops should be green manured, because the gain in succeeding crops is greater than the loss of a kharif crop.

India is losing very much of its soil nitrogen by growing oilseeds and getting nothing for the recuperation of the soil in return, because most of the seeds are exported and nothing is returned to Indian soils. Besides this all oil cakes available in the country are considered better as a cattle food than as a manure and therefore dearer to use as manure. But such cakes as *neem mahua*, castor etc. that have no feed value are very cheap and to get the best return from them they should be applied as manure.

Their application at ten to fifteen maunds per acre is quite sufficient. Different cakes contain different percentages of plant food nutrients. Their nitrogen content varies from 3·5 to 5 p. c., that of phosphorus 2 to 3 p. c. and of potash 2 to 3 p. c. Castor has 5 p. c. of nitrogen and *mahua* 3 p. c. This also, to some extent, adds organic matter to the soil and improves the texture. It is quicker in action than compost or farmyard manure.

In India many bones are being wasted which could be very profitably utilised both as manure and as cattle feed. Due to religious prejudice there is very little possibility of using them. If bones be crushed and used as manure they will add to the soil from 4 to 5 p. c. of nitrogen and 20 p. c. of $P_2 O_5$ and 25 p. c. of calcium. It is a very slow-acting, but persistent manure. For fruit garden plants it is very useful.

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Knowledge and timber should not be much used till they are seasoned.

—O. W. HOLMES.

NOT SO MELANCHOLY

"The Dane has made his country a model for the world in the wise and profitable organization of agriculture, in education, and in co-operative community life."

BY AGNES MACPHAIL,

Member of the Canadian House of Commons.

Denmark is beautiful. The coziness of the thickly populated and well tilled countryside can scarcely be exaggerated. The gleaming white farm buildings with their contrasting roofs of red tile, set close together in a rectangle, are protected and beautified by tree plantings. They look like homes where happy and contented people dwell.

Many visits to many farms bear out this passing judgment. Whether the farmer is a small, medium, or large holder, he is deeply interested in scientific agriculture and, in the majority of cases, a co-operator with his fellow farmers, in all cases, the proud owner of a homestead. He is building for the future as well as for the present and knows that his work will be inherited and appreciated by his children.

Conversations with Danish farmers reveal their interest in intellectual subjects. They read widely; almost every home has its library shelf. Possibly not more than a dozen books, but good ones. He is on familiar terms with international trade agreements, tariffs and quotas. He probably speaks a little English and apologises that he is not more proficient.

It would be misleading, however, if one did not stress the industry and frugality of the Danish farmer. The whole family works long hours and lives an economical, though comfortable life.

The farmer is a courteous host. He is willing and even eager to tell the vistor all he can about the business management of his farm. He gets his farm ledger down

and from it verifies the statements that he makes. He is even willing to show his foreign guests through his house, with its comfortable sitting rooms in addition to kitchen, scullery and bedrooms. He is obviously pleased when you praise its comfort and beauty. And why shouldn't he be?

How is it that the Danish farmer can live comfortably when his brother in other lands is in despair?

The answer is romance—the romance of a small, discouraged, poor and almost defeated nation being awakened by high leadership and noble words to a belief in themselves, and incidentally, contentment and prosperity.

Bishop Grundtvig, now called the "Prophet of the North," was the great Danish leader of the nineteenth century. He was a poet and a thinker, but in addition, a man of great dynamic energy.

In his desire to build a new Denmark, Grundtvig turned to education as a means. He condemned the dry, dead classical schools of his day and talked much of schools for the people. These, he thought, should gather in young adults after they had spent some years in active life on farms or in workshops. It is, he said, between the ages of eighteen and twenty-five that the mind is full of questions. The schools should find an answer to the questions. As Grundtvig saw it, the school should educate for life, not for a position in life; it should help the young adult to take his place in history and should make clear that the individual can have no life apart from his fellows.

Grundtvig chose for his teaching three vehicles: history, Danish language and literature and song. History, not as a meaningless mass of details but as a living continuity, an organic development, the career of mankind. Through it youth would see itself not as a spectator but as a participant in the making of history. The inspirational literature of the Danes was an instrument used to arouse and inspire, but in every case the "living

word" was the medium through which the teacher reached the student.

After much struggle, schools based on Grundtvig's philosophy came into being. There are today sixty of these and they are known the world over as the Folk High Schools of Denmark. Between one quarter and one third of all Danish farmers have attended such a school at least once in their lives.

While co-operation as a subject plays no part, nevertheless these schools awakened the Danish peasant to various activities in common and stirred in him a desire for knowledge. The Folk Schools, then, are the unseen but solid foundation on which the co-operative movement of Denmark rests.

Eighty per cent of the cultivated Danish soil is in the possession of farmers with small or medium-sized holdings. Experience has shown fifteen hectares ($37\frac{1}{2}$ acres) to be the ideal unit. It was such farmers as these that set up the first co-operative dairy as early as 1882. By their joint effort they set a standard for quality of butter that captured the British market and set them above all competitors.

Co-operation has been the shock absorber which has saved the farmer from the worst effects of the world depression. Instead of processors reaping huge profits while the farmers were impoverished, they, being their own processors, got whatever profits there were in the packing and dairying industries. Not only that, but being their own wholesalers and manufacturers, they paid less for the necessities of life and assured themselves of high quality goods.

Today, the farmer lives in a maze of co-operation. He gets his working capital from a co-operative credit society; he sells his products through the great producers' organization; 86 per cent of all milk is processed in 1400 co-operative dairies and 80 per cent of all pigs are slaughtered and the meat cured in co-operative slaughter houses. He buys a large part of his imported feed and

fertilizers through co-operative purchasing societies and 70 per cent of all household necessities are purchased through consumers' co-operatives.

In addition to all that, seed for the fields and stock for the farms are purchased through co-operative seed and breeding associations.

Co-operatives themselves co-operate to purchase or manufacture the machinery and supplies required. For example, the co-operative dairies have a purchasing and manufacturing society of 22 branches, which supplies its members with the necessary implements, machines and materials of good quality and as cheaply as possible by joint purchase or from its own factory.

It is no exaggeration to say that agricultural Denmark is a co-operative commonwealth.

This working together has been the chief factor in enabling the Danish farmer to capture and hold the British, and to a lesser degree the German market for butter, eggs and bacon and to set a standard for quality and uniformity, and steadiness of supply, which is the envy of other peoples.

While retaining individualism in production, co-operation has given the farmer the advantages of large-scale machinery in dairies and slaughter houses and these by mutual agreement among the many units are able to adapt and limit quickly their production to the changing needs of markets, which needs they most carefully study and meet.

If the Englishman wants a white egg for breakfast, a white egg he gets, though it means changing the breed of the laying flocks. If he wants bacon with alternate layers of lean and fat, the Dane through his co-operative, studies breeding and diet to produce the desired result.

The Danish farmer pleases all his customers. The German likes his bacon fat. Then the farmer produces a special type of hog for the German market. On a small farm visited, the piggery was divided into English and

German pens. The models for the English were streamlined but for the Germans thick and fat. The type of hog was different and the feeding was not the same though skim milk formed part of the diet of each. There is a very close connection between dairying and hog production. Only farmers who keep cows can produce hogs for the foreign market, since skim milk improves the the quality of the bacon.

Even with the exacting care exercised in production, the finished product is not necessarily considered fit for the export market. Inspectors approved by the government but paid by the co-operatives carefully examine the products and pass for export only A-1 grades. The approved produce is marked with the Lure brand, which indicates both quality and nationality. Should any defect appear when the product is being sold on a foreign market, it can be traced back to its source.

In the management of co-operative enterprises, each member has one vote. This is true irrespective of the use he makes of the society's facilities. It is true in the dairies, regardless of the number of the cows kept; or in the packing houses the number of hogs slaughtered. The same rule is carried through in the co-operative wholesale society which is the organization supplying by purchase or manufacture the needs of the many retail units throughout the country.

This practice comes naturally from the intensely democratic farmers, trained in folk schools which stress the value of personality so much.

The general assembly of a given co-operative, which meets once a year, elects a committee as its executive body. This committee is in control of the affairs of the organization and the manager of each concern is responsible to the committee. The shrewdness of the Dane is shown in the way he ties the manager up with the success of the business. For instance, the manager of a dairy derives his income from milk. According to contract, he obtains for himself a percentage of the milk

delivered. He becomes personally interested in the economic result of the dairy since his own salary is dependent on the price paid to the farmers, both the immediate price they get when the milk is delivered and the dividends which come later. In addition, he is supplied with a free house and garden.

The salary of the manager of a retail co-operative is five per cent of the annual turnover, with certain exceptions such as coal and timber, on which goods he gets two per cent of the gross cost. He also receives a house, but has to pay an assistant out of his salary. Nor is any manager employed who cannot deposit a certain sum as a guarantee, which is avaible to the society he serves if it suffers a loss through poor management.

Part of the strength of the Danish co-operative movement is due to the fact that those participating in the venture contract to deliver their products, or purchase their supplies, for a given number of years. This enables the management to make definite plans on a known volume of business.

An even greater factor is the thoroughly honest character of the Danes. When I asked the Burgomaster of Elsinore, a high official in the co-operative moment, if they had had trouble with graft, he did not understand what I meant. After a careful explanation, however, he exclaimed: "Such a thing is incredible!"

The "homely" atmosphere of the retail co-operative shops is giving way before efficiency. Attractive display of goods and the stressing of quality and arrangement are increasing. Sweden, admittedly the leader in the consumer field, is affecting Denmark. Recently a Swedish film showing the methods used in retail co-operatives was shown in Denmark in order to stimulate the farmer's aesthetic taste in commercial enterprises.

The Co-operative Wholesale Society which supplies the local units with its wares has become its own

(Continued on page 176)

Our Former Students.

Coles Ackerman Memorial
Boys High School,
Nellore, South India.
18-3-1937.

Dear Friends,

I am in receipt of your circular letter of January 15, 1937. I thank you very much for the same. I feel happy beyond measure to hear about all the changes, of course, changes for the better, through which our Institute has passed. Ever since I left the Institute in 1928 I have been in touch with her through Dr. Higginbottom, Mr. Hayes and some of my classmates like Messrs. S.R. Misra and S. N. Lal. I heard from Mr. Hayes that they were contemplating to start there degree course and affiliate the institute to the Allahabad University. This was my long cherished desire and I feel now immensely glad to see my desire fulfilled by the untiring efforts of Dr. Higginbottom. My heart is thrilled to read about the all-sided developments of our Alma Mater.

I am not at all surprised to hear that Dr. and Mrs. Higginbottom are still there in sound health to carry on the work for many more years to come. The Institute is fortunate to have the services of Mr. and Mrs. Hayes, Messrs. Vaugh, Hatch and Brooks. When Mr. Brooks was leaving the Institute, after we left it, we were given to understand that he was leaving it for good. It gives me great pleasure to hear that the good teacher has returned to his work. Among the Indian staff Mr. N. R. Joshi and Dr. B. B. Malvea are familiar to us though at that time Dr. Malvea was not connected with the Institute.

I fully concur with your views that the Old Boys of the college which is growing and turning out great work should be closely knit to their Alma Mater. I am sure

that all the other Old Boys share the same view. I thank from the bottom of my heart all the organizers of the Institute student union for the step they have taken in celebrating the Old Boys' Day.

Let me now answer your questions direct. I agree and feel it a necessity that Old Boys of an institution like ours should be organized. This organization can, I feel, effectively be carried on by an executive body appointed by the Old Boys' Association. I would like to see the Principal or the Vice-Principal made responsible for the organization. It may not be possible for all of us to get together some time during this year as many of the Old Boys are from outside the U. P. But certainly it must be possible for many of the U. P. people to get together.

I would suggest the following for the effective organization of our Old Boys' Association: Let the Principal be made the President and one from among the Old Boys, Vice-President. Let two joint secretaties be elected, one to be from the Old Boys, and preferably from those living in or near Allahabad, and one from the among the present staff and students. Personally I would like all the office-bearers to be elected from among the Old Boys but this will not work effectively. I have seen many such orgnizations being active only for a short while as they, afterwards in the midst of their numerous duties, will not be able to do their part properly. If the majority on the executive body be from those who are very closely and directly connected with the Institute or from those living in and near Allahabad the organization will work effectively. Many such organizations working effectively here are of that nature. This suggestion may hold good only for some years to come when our Old Boys are made to feel to run it themselves. In this connection the treasurer is to be elected from the staff. The executive committee can co-opt members. All Old Boys must be requested to become members and the membership fee is to be not less than Rs. 2 per year.

Dear friends, later on at leisure I may submit to you for your consideration, a detailed scheme for effectively carrying on our Old Boys' Assocation.

Now I want to tell you something about myself since you have asked me to do so. I am one of the two students who passed from the Institute the I. Ag. Diploma course in first class in 1928, the other being a friend of mine from Mangalore in S. India. After passing this course I worked for 2 years as Agriculture Instructor in the Coles Memorial High School, Kurnool, S. India, teaching agriculture as a compulsory and as an optional subject to IV, V and VI forms. Sixth form is the same as Matric of the other Universities.

While working there I tried to get admission into the Agricultural College at Poona for the B. Ag. Degree course. The University of Bombay did not admit me to the Degree course on the plea that the I.Ag. of Allahabad is not deemed equivalent to the I.Ag. or I. A. or I. Sc. of the Bombay University. With the help of Dr. Higginbottom and the Secretary to the U. P. Board of High School and Intermediate Education I could at last succeed in getting admission to the Degree course at Poona in 1930. I am the only man who could get admission to the B. Ag. Degree course of the Bombay University after passing the I. Ag. course from Allahabad. Others also from the Institute were admitted, at least two who were my classmates, but they were admitted because they were I.Sc. students.

I passed my I.Ag. from Bombay University in 1st class and stood 2nd in the University. In all the class examinations I was coming out second. In the B.Ag. Degree examination I came out in 2nd class but stood 2nd in the University. I failed to get a first class for want of only 3% marks. You may think that I am blowing my own trumpet but this I do in order to show what the products of the Institute can do.

Now I am working in the C.A.M. High School, Nellore, as Science Assistant on Rs. 73/. I am also

managing the 14 acre farm attached to our high school. Some poor boys are helped to earn their school fees by working on the farm. We are growing on the farm indigenous crops like chillies, paddy, brinjals, melons, gourds, and some English vegetables like tomatoes, cabbages, knol-khols, and beets. We have got attached to our farm a big poultry. We are also rearing some Surti goats.

I may have given you some unnecessary and unwanted details. Please pardon me for this. I once applied to Mr. Hayes for a place in the Horticulture Department but he said that he would write to me if they require hands. He also expressed his doubt whether the University would permit a Bachelor's Degree holder on the staff. We ordered some plough shares from the Institute sending some samples but no reply. Thanking you for your patience.

Yours sincerely,
(Sd.) K. Raja Rathnam.

Dear Dr. Higginbottom,

I am sincerely thankful to you for the invitation which you have extended to me. I am really very glad to hear the news of marriage of charming lady Elizabeth with Mr. William Clough. Pray to God that they have a happy and long peaceful married life.

I so much like to run away from here and to meet you but circumstances do not permit me. I am always anxious to hear of the Institute and to know the welfare of you all. Truly, I love the Institute and have deep sincere respect for you. You are always an example for me in the guidance of my life. The unique thing and the asset of the Institute is the good feeling between staff and student which enables the student to learn

things which he cannot get in any book in the world. The spiritual help which you try to give is also a matter of great importance. I feel that for success in life right spiritual guidance is an essential thing.

I am doing quite well in practical farming. From cane I am getting one and half times more than what we were getting so long. From next year I hope to double the income of the farm. My father remarks that the money spent on my education has been very well spent.

Hope this finds you in best health and spirit. With sincere regard.

Sincerely your,
A. K. MITRA.

Ramgharwa Concern,
Ramgharwa.

NOT SO MELANCHOLY

(*Continued from page 171*)

importer and is gradually becoming a manufacturer of great magnitude, already turning out confectionery, tobacco, soap, clothing, shoes, bicycles, among other things. It has an annual turnover of 135,000,000 crowns.

Thus, step by step, the Danish peasant has raised his financial and cultural standing. Beginning with the processing of his farm products, he gradually extended his activities to cover all his needs; until today he, with his fellows, affects, and in many cases controls, their economic cultural and social life and has made little Denmark a model for the world.

—*From The Christian Science Monitor.*

World Agricultural Notes

World Maize Trade

In the "Monthly Crop Report and Agricultural Statistics" the International Institute of Agriculture of Rome, publishes a survey of the International maize market with reference to the production of this cereal in the northern hemisphere and to the agricultural and trade policies adopted by the various countries. Three tendencies are discernible in agricultural policies: (1) In the United States, the world's largest producer, the attempt to increase the price of the product by reducing the area is being continued; (2) in Agrentine, Romania, Yugoslavia and the Union of South Africa, which are the most important exporters of maize and which sometimes encounter difficulties in placing their surpluses abroad, there is a tendency to make no further increases in the area devoted to the crop but to improve cultural methods and to increase domestic consumption; (3) in the countries which produce but which also import this product (the most important being Italy and France) there is a tendency to increase production, in particular, by raising the yield per acre, in order to reduce or eliminate imports.

The 1936 maize harvest was disastrous in the United States, poor in Romania, and good or excellent in the other producing countries for which returns are available. Owing to the dominant position of the United States as a producer of maize, the average yield and total production in the northern hemisphere in 1936 were very low. The average yield in 1936 in 13 countries was barely 18.0 bushels per acre as against 22.8 in 1935 and 22.0 in the quinquennium 1930-1934. Production in the northern hemisphere is consequently 23 to 24 per cent below the 1935 level and the five-year average.

As for consumption, the chief result is that, in all probability, the United State will continue to import substantial amounts of maize from Argentine. Hungary on the other hand, though it imported large quantities in the previous year (13.0 million bushels) will appear among the exporters in 1936-37,

The large supplies of maize available in Argentina from the plentiful harvest of March-April 1936 and the substantial surpluses in the Danube countries can be easily absorbed by the United States and by the maize importing countries where the harvest of barley and oats, which frequently provide a substitute for maize, was poor in 1936.

To judge from the experience of recent years, the maize requirements this year in the maize importing countries are normal while those of barley and oats are larger than the average. The survey also provides a diagram showing the course of prices of maize, barley and oats on the Liverpool-London markets from May 1925 to November 1936. This diagram indicates the notable rise that occurred in the prices of these three cereals between February and August 1936 and the clear similarity between 1934 and 1936, evidently arising from the disastrous maize crops of the United States in these two years.

(International Institute of Agriculture, Rome, January 1937.)

Speech by His Excellency Sir Harry Haig, K.C.S.I., C.I.E., I.C.S., *Governor of the United Provinces of Agra and Oudh, at the laying of the foundation stone of the Lucknow University Library, March 4,* 1937 :— Coming to attend this important ceremony today, I am reminded how many of the problems of modern life arise from elaboration. Whether it be mechanical processes for production or for transport, or the problem of government, or the requirements of education or research, elaboration or complication grow continually. There may be those who look back with regret on an earlier and simpler period when the perfection of machines did not threaten us with over-production, when the relationship of life and the factors of politics and economics were easier to disentangle, when the material for education was more limited and more uniform, books were comparatively few and the general education of the day was comprehended within a fairly restricted compass. But whatever may have been the merits of the past, we must recognize that it is past, and that we have to concern ourselves with the present and the conditions of the present.

LAND RECLAMATION IN ITALY

One of the achievements of which Italy can unreservedly be proud is the reclamation of large areas of land that for centuries remained marshy. An idea of the vastness of the operations and their popularity may be gauged from the following figures:—

Labour employed	..	18 million man-days.
Area reclaimed.	..	47 million hectares (2.47 acres.)
Increase in out-put	..	2 million metric tons (2,000 lbs.)
Fall in imports %	..	about 80.0

Of much greater interest perhaps to this country is the way in which the Italian Government tackled what is known as the "Southern Question" consisting of a group of problems arising out of the backward economic and social conditions of South Italy. The general machinery is prescribed by the Mussolini Act which characteristically does not lose itself in the maze of existing measures. It leaves them as they are and goes straight forward. Financial provision of 7000 million lire is made to be spent in the course of 14 years. Half of this amount is chargeable to the treasury and the remainder to the land owners. The major part of the finance is provided to the parties concerned in the form of 30-year annuities discounted to them by different institutions. The scheme aroused such great enthusiasm that applications for funds were so numerous that the alloted sum was found far too small to meet them all. Preference was given for the execution of the work of public bodies which ensured a certain minimum of private initiative. Private rights were acknowledged and when curtailed, were said to be adequately but not excessively compensated. A special section of the Ministry of Agriculture which receives proposals and itself draws up plans, deals with land reclamation and no project is accepted unless it shows considerable possibility of securing notable improvements in hygiene, demographic, economic, and social conditions,

The plan being accepted by government, the land owners proceed to execute the works either by themselves or through the consortium. They may provide all the money themselves or obtain government grants or special loans from the agricultural bank. When the reclamation is completed, some internal migration and land settlement become necessary. A special commissariat like the "Ex-service Men's League" attended to this and the migrants were drawn mainly from farm workers brought from more densely settled regions. The system adopted was as follows :—The reclaimed land is cut up into holdings of 25 to 75 acres according to the quality of land, each furnished with a house, stabling for ten cattle, poultry run, pig sty, well, etc. The farms are taken by the immigrants first on a crop sharing basis the tenants receiving monthly advances in the shape of supplies and cash allowances from the League or other societies. When the head of the family gets experienced, an agreement is drawn up under which he will purchase the farm and the livestock from the League in 15 annual instalments covering capital and interest which varies in general from 200 to 630 lires ($9\frac{1}{8}$) per hectre as cost of upkeep and amortisation of the drainage work. These payments do not cover the government contribution.

(The Madras Agricultural Journal, Vol. XXV, No. 1, January, 1937.)

To provide water to meet the growing needs of thirteen cities in southern California, including Los Angeles, an aqueduct is being constructed from the Colorado river. The main line is 242 miles long, and the distributing mains will total 172 miles. The aqueduct will deliver one billion gallons of water a day. As it crosses mountains, construction involves 108 miles of tunnels, 28 miles of siphons and five pumping stations. The estimated cost is $220,000,000.

It is now being proposed that part of the water be used for irrigation of the famous citrus orchards of southern California. These are now mostly irrigated by water from tube wells, and as the supply is inadequate, the underground water level is falling. It has been suggested that the water be provided for agricultural use at the rate of $15 per acre foot.

Meteorological Observations

FEBRUARY, 1937

Date.	Maximum Temperature.	Minimum Temp	Mean Temp	Percentage of Humidity.	Pressure of the Atmosphere.	Wind direction.	Rain for the day.	Rain since Jan. 1.	Remarks.
1	79	44	61·5	98·0	29·8	E.S.E.	Nil	Nil	Beating sanai.
2	66	42	54·0	80·0	29·81	E S.E.	Trace	Nil	Beating sanai.
3	81	46	63·5		29·74	S.W.	Nil	Nil	Winnowing guara.
4	83	50	66·5	73·0	29·69	N.W.	Nil	Nil	Storing sanai.
5	84	52	68·0	65·0	29·74	S.E.	Nil	Nil	Making san rope.
6	80	53	66·5		29·74	Calm	Nil	Nil	Making san rope.
7	82	56	69·0		29·70	N.E.	Nil	Nil	Making san rope.
8	80·0	54·0	67·0	100·0	29·65	N.E.	Trace	Nil	Making san rope.
9	88·0	62·0	75·0	100·0	29·62	S.E.	·25	0·25	Cutting sanai.
10	84·0	61·0	72·5	100·0	29·68	S.E.	·1	0·35	Cutting sanai.
11	78·0	60·0	69·0	100·0	29·6	S.E.	·1	0·41	Cutting sanai.
12	69·0	60·0	64·5	100·0	29·63	S.E.	·08	0·49	Cutting guara.
13	63·0	57 0	60·0	78·0	29·7	S.E.	Nil	0·49	Cutting guara.
14	69·0	52·0	65·0		29·78	E.S.E.	Nil	0·49	Cutting guara.
15	74·0	49·0	61·5		29·74	E.	Nil	0 49	Threshing guara.
16	76·0	48·0	62·0		29·76	E.	Nil	0 49	Threshing guara
17	81·0	53·0	67 0	72·0	29·78	E.N.E.	Nil	0·49	Threshing guara.
18	85·0	53·0	69·0	80·0	29·72	W.	Trace	0·49	Threshing sanai.
19	80·0	51·0	65·5	73·0	29·68	S.W.	Nil	0·49	Sowing bajra.
20	81·0	50·0	65·5	50·0	29·68	E.	Nil	0 49	Sowing bajra
21	80·0	50·0	65·0	68·0	29 67	N E.	·35	·89	Sowing bajra.
22	82·0	51·0	66·5	79·0	29·66	E	Trace	·89	Irrigating Napier and vegetables.
23	83·0	50·0	66·5	70·0	29·66	W.	Nil	·89	,, ,,
24	78·0	50·0	64·0	74 0	29 67	S.E.	Nil	·89	,, ,,
25	84·0	51·0	67·5	74 0	29·4	E.	Trace	·89	,, ,,
26	83·0	61·0	72·0	83·0	29·5	S.E.	·65	1·54	Sowing bajra.
27	82·0	60·0	71·0	81·0	29·5	S.E.	Nil	1·54	Irrigating Napier.
28	81·0	60·0	70·5	82·0	29·54	S.	Nil	1·54	,, ,,

MARCH, 1937

Date.	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Pressure of the Atmosphere.	Wind direction.	Rain for the day.	Rain since Jan. 1	Remarks.
1	82·0	55·0	68·5	52·0	29·57	W.	Nil	1·54	Digging potatoes.
2	81·0	52·0	66·5	56·0	29·50	W.	Nil	"	Digging potatoes.
3	83·0	60·0	71·5	63·0	29·26	Calm	Nil	"	" "
4	90·0	59·0	74·5	52·0	29·49	N.E.	Nil	"	" "
5	91·0	53·0	72·0	56·0	29·5	S.W.	Nil	"	" "
6	92·0	49·0	70·5	68·0	29·6	Calm	Nil	"	Selling rabi vegetables.
7	88·0	50·0	69·0	48·0	29·62	E.	Nil	"	" " "
8	90·0	60·0	75·0	50·0	29·59	E.	Nil	"	" " "
9	96·0	58·0	77·0	42·0	2 ·52	E.	Nil	"	Marketing tomatoes, brinjals onions potatoes and cabbage; ploughing land between arhar.
10	92·0	52·0	72·0	38·0	29·56	W.	Nil	"	" "
11	87·0	50·0	68·5	44·0	29·60	W.	Nil	"	" "
12	88·0	62·0	75·0	42 0	29·52	W.	Nil	"	" "
13	89·0	60·0	74·5	38·0	29·54	S.W.	Trace	"	" "
14	94·0	54·0	74·0	40·0	29·56	N.E.	Nil	"	" "
15	96·0	58·0	77·0	39·0	29·62	S.W.	Nil	"	" "
16	94·0	54·0	74·0	50·0	29·60	S.	Nil	"	" "
17	90·0	53·0	71·5	51·0	29·52	W.W.N.	Nil	"	" "
18	90·0	52·0	71·0	39·0	29·56	S.E.	Nil	"	Selling vegetables.
19	96·0	53·0	74·5	36·0	29·54	W.	Nil	"	" "
20	97·0	56·0	76·5	35·0	29·52	S.	Nil	"	" "
21	97·0	54·0	75·5	35·0	29·52	S.W.	Nil	"	" "
22	96·0	55·0	75·5	38·0	29·54	E.	Nil	"	Harvesting and threshing.
23	102·0	60·0	81·0	57·0	29·54	S.E.	Trace	"	" "
24	100·0	64·0	82·0	39·0	29·52	W.	Nil	"	" "
25	101·0	66·0	83 5	50·0	29·60	Calm	Nil	"	" "
26	92·0	56·0	74·0	47·0	29·60	W.	Nil	"	" "
27	94·0	53·0	73·5	45·0	29·57	S.W.W.	Nil	"	" "
28	95·0	52·0	73·5	39·0	29·56	W.	Nil	"	" "
29	96·0	54·0	75·0	38·0	29·54	Calm	Nil	"	" "
30	96·0	74·0	85·0	35·0	29·47	W.	Trace	"	" "
31	99·0	66·0	82·5	42·0	29·44	E.	0·15	1.69	" "

Sir Jogendra Singh, Minister for Agriculture, Punjab, in the course of his address before distributing prizes to the successful exhibitors at the Fruit Show, organized by the Punjab Agricultural Department said :— * * * India imports fresh and preserved fruits worth Rs. 1,26,04,524. Major-General R. McCarrison holds that deficiency in diet is responsible for inefficiency of our labour. His Excellency the Viceroy has drawn pointed attention to this problem and we may well hope that the Finance Department of the Government of India will turn its eyes from problems of raising revenue to the need of resources from which revenue could flow as water from an artisian well. Provinces with their limited sources of revenue can do little without the active co-operation of the Government of India. Colonel McCay's investigations have led him to the conclusion that the protein factor determines the place of Indian races in the scale of physical efficiency. He traced all differences in physique to the different levels of nitrogenous interchange possible in the diet of wheat eaters and the diet of rice eaters. It is clear from what these authorities say that the more fruit the people eat, the greater is their capacity for work and enjoyment of health and happiness. From my long experience in agriculture, I know what the peasant with his small holding needs. It is a money crop, so that he could pay all the money demands by growing fruit and other money crops and keep the cereals to himself.

VOL XI] [No. 4

THE ALLAHABAD FARMER

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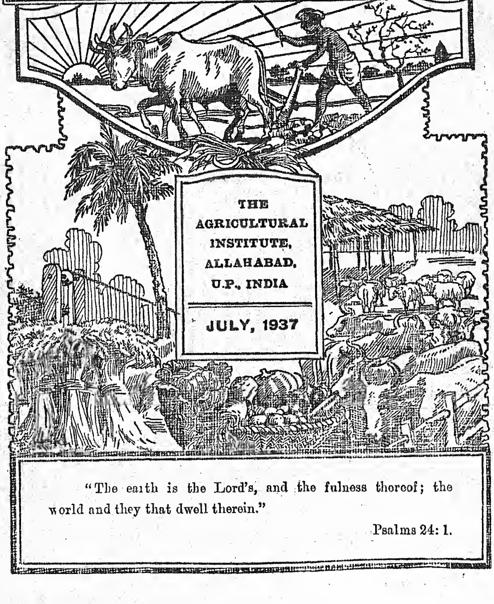
OF

Agriculture and Rural Life



THE

AGRICULTURAL INSTITUTE,

ALLAHABAD,

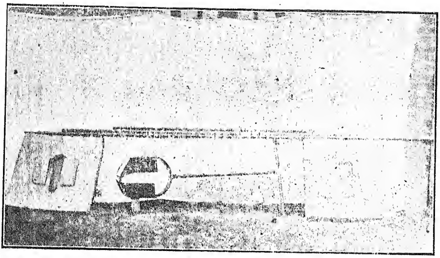
U.P., INDIA

JULY, 1937

"The earth is the Lord's, and the fulness thereof; the world and they that dwell therein."

Psalms 24: 1.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agr icultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours..

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro. Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by 3½ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

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AND RURAL LIFE

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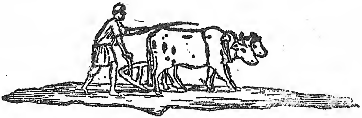
The Allahabad Farmer

Vo. XI] JULY, 1937 [No. 4

Table of Contents

THE ALLAHABAD FARMER



VOL. XI] JULY, 1937 [No. 4

Editorial

From time to time throughout history someone has spoken out to remind men of how intimately their daily tasks are bound up with the Divine purpose. Sometimes it is a lonely prophet crying out against the forgetfulness of his people. Sometimes it is a scholar, recalling his fellows from their preoccupation with the details of every day. Occasionally it is a whole group of people.

For two years now, there have been coming to the ALLAHABAD FARMER the bulletins of a new group of persons in the United States of America known as the Christian Rural Fellowship. It is a group of persons, all of them interested in agriculture and in rural life and most of them technically trained in one or another branch of agricultural science, who feel that there are truths and values inherent in agriculture and in rural life of which we should be aware and which we should seek. As they themselves state their purpose, it is "to promote understanding and appreciation of the religious and spiritual values which abide in the processes and relationships of agriculture and rural life; to define their significance and relate them to the Christian enterprise at home and abroad."

We feel that certain of these bulletins are so valuable and so much needed in our work of rural education in India that we are devoting this entire issue of the ALLAHABAD FARMER to the reproduction of some of these bulletins. Credit for each of the articles is due to the Christian Rural Fellowship.

Speech by His Excellency the Viceroy in reply to the welcome address presented to him by the Secretary of the Pinjrapole Society, New Delhi:—
* * * As you are well aware the cow possesses no sacramental significance to persons of the faith to which I adhere. My interest in cattle improvement springs from conviction that the working bullock and the cow form the foundation of Indian agriculture and, that if we are able to bring about an improvement in our cattle we shall have achieved that which will make a very substantial contribution towards improving the economic position of the country and also towards bettering the the health to our people. Let me assure you, that I am quite confident that the thing is within our power, if we all work together with courage and determination. The first purpose of my visit to-day is to present to this Pinjrapole six cows and a female buffalo. The cows are from Calcutta, and the buffalo cow is from Bombay, in which city buffalo milk supplies an important part of the public demand. These seven animals have all been in urban dairies. Their period of lactation had come to an end and if I or someone else had not bought them for return to the countryside and the pastures they would by this time have been slaughtered I have taken this action because I am anxious to draw the attention of all persons in India to the excellent opportunities to obtain animals of good appearance and with good milk yields, afforded by these sales of dry cows in urban areas. My strong hope is that these cows and this buffalo will all have further calves and a good yield of milk. If any of these fail to have further calves that fact will be a strong presumptive evidence that they have been subjected to the grossly cruel and inhuman practice called *phuka*, which is designed to prolong the lactation period. That practice is a disgrace to all that is best in India and it must be stopped and rooted out. I hope that the local authorities and the public will support me in this determination and do their best by exercising effective restraint upon, if necessary, by punishing those that practice *phuka* to protect our cows from this horrible maltreatment.

THE HOLY EARTH

BY LIBERTY HYDE BAILEY

So bountiful hath been the earth and so securely have we drawn from it our substance, that we have taken it all for granted as if it were only a gift, and with little care or conscious thought of the consequences of our use of it; nor have we very much considered the essential relation that we bear to it as living parts in the vast creation.

It is good to think of ourselves—of this teeming, tense, and aspiring human race—as a helpful and contributing part in the plan of a cosmos, and as participators in some far-reaching destiny. The idea of responsibility is much asserted of late, but we relate it mostly to the attitude of persons in the realm of conventional conduct, which we have come to regard as very exclusively the realm of morals; and we have established certain formalities that satisfy the conscience. But there is some deeper relation than all this, which we must recognize and the consequences of which we must practice. There is a directer and more personal obligation than that which expends itself in loyalty to the manifold organizations and social requirements of the present day. There is a more fundamental co-operation in the scheme of things than that which deals with the proprieties or which centres about the selfishness too often expressed in the salvation of one's soul.

We can be only onlookers on that part of the cosmos that we call the far heavens, but it is possible to co-operate in the processes on the surface of the sphere. This co-operation may be conscious and definite, and also useful to the earth; that is, it may be real. What means this contact with our natural situation, this relationship to the earth to which we are born, and what signify this

new exploration and conquest of the planet and these accumulating prophecies of science? Does the mothership of the earth have any real meaning to us?

All this does not imply a relation only with material and physical things, nor any efforts to substitute a nature religion. Our relation with the planet must be raised into the realm of spirit ; we cannot be fully useful otherwise. We must find a way to maintain the emotions in the abounding commercial civilization. There are two kinds of materials—those of the native earth and the idols of one's hands. The latter are much in evidence in modern life, with the conquests of engineering, mechanics, architecture, and all the rest. We visualize them everywhere and particularly in the great centres of population. The tendency is to be removed farther and farther from the everlasting backgrounds. Our religion is detached.

We come out of the earth and we have a right to the use of the materials; and there is no danger of crass materialism if we recognize the original materials as divine and if we understand our proper relation to the creation, for then will gross selfishness in the use of them be removed. This will necessarily mean a better conception of property and of one's obligation in the use of it. We shall conceive of the earth, which is the common habitation, as inviolable. One does not act rightly towards one's fellows if one does not know how to act rightly toward the earth.

Nor does this close regard for the mother earth imply any loss of mysticism or of exaltation– quite the contrary. Science but increases the mystery of the unknown and enlarges the boundaries of the spiritual vision. To feel that one is a useful and co-operating part in nature is to give one kinship, and to open the mind to the great resources and the high enthusiasms. Here arise the fundamental common relations. Here arise also the great emotions and conceptions of sublimity and grandeur, of majesty and awe, the uplift of vast desires—when one contemplates the earth and the universe and desires to

take them into the soul and to express oneself in their terms; and here also the responsible practices of life take root.

So much are we now involved in problems of human groups, so persistent are the portrayals of our social afflictions, and so well do we magnify our woes by insisting on them, so much in sheer weariness do we provide antidotes to soothe our feelings and to cause us to forget by means of many empty diversions, that we may neglect to express ourselves in simple free personal joy and to separate the obligation of the individual from the irresponsibilities of the mass.

In the Beginning

It suits my purpose to quote the first sentence in the Hebrew Scripture: "In the beginning God created the heaven and the earth."

This is a statement of tremendous reach, introducing the cosmos; for it sets forth in the fewest words the elemental fact that the formation of the created earth lies above and before man, and that therefore it is not man's but God's. Man finds himself upon it, with many other creatures, all parts in some system which, since it is beyond man and superior to him, is divine.

Yet the planet was not at once complete when life had appeared upon it. The whirling earth goes through many vicissitudes; the conditions on its fruitful surface are ever-changing; and the forms of life must meet the new conditions—so does the creation continue, and every day sees the genesis in process. All life contends, sometimes ferociously but more often bloodlessly and benignly, and the contention results in momentary equilibrium, one set of contestants balancing another; but every change in the outward conditions destroys the equation and a new status results. Of all the disturbing living factors, man is the greatest. He sets mighty

changes going, destroying forests, upturning the sleeping prairies, flooding the deserts, deflecting the courses of the rivers, building great cities. He operates consciously and increasingly with plan aforethought; and therefore he carries heavy responsibility.

This responsibility is recognized in the Hebrew Scripture, from which I have quoted; and I quote it again because I know of no other Scripture that states it so well. Man is given the image of the Creator, even when formed from the dust of the earth, so complete is his power and so real his dominion: And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

One cannot receive all these privileges without bearing the obligation to react and to partake, to keep, to cherish and to co-operate. We have assumed that there is no obligation to an inanimate thing, as we consider the earth to be; but man should respect the conditions in which he is placed; the earth yields the living creature; man is a living creature, science constantly narrows the gulf between the animate and the in-animate, between the organized and the unorganized; evolution derives the creatures from the earth; the creation is one creation. I must accept all or reject all.

The Earth is Good

It is good to live. We talk of death and of lifelessness, but we know only of life. Even our prophecies of death are prophecies of more life. We know no better world—whatever else there may be is of things hoped for, not of things seen. The objects are here, not hidden nor far to seek: And God saw everything that he had made, and, behold, it was very good.

These good *things* are the present things and the living things. The account is silent on the things that were not created, the chaos, the darkness, the abyss. Plato, in the "Republic," reasoned that the works of the creator must be good because the creator is good. This goodness is in the essence of things; and we sadly need to make it a part in our philosophy of life. The earth is the scene of our life, and probably the very source of it. The heaven, so far as human beings know, is the source only of death; in fact, we have peopled it with the dead. We have built our philosophy on the dead.

We seem to have overlooked the goodness of the earth in the establishing of our affairs, and even in our philosophies. It is reserved as a theme for preachers and for poets. And yet, the goodness of the planet is the basic fact in our existence.

I am not speaking of good in an abstract way, in the sense in which some of us suppose the creator to have expressed himself as pleased or satisfied with his work. The earth is good in itself, and its products are good in themselves. The earth sustains all things. It satisfies. It matters not whether this satisfaction is the result of adaptation in the process of evolution; the fact remains that the creation is good.

To the common man the earth propounds no system of philosophy or of theology. The man makes his own personal contact, deals with the facts as they are or as he conceives them to be, and is not swept into any system. He has no right to assume a bad or evil earth, although it is difficult to cast off the hindrance of centuries of teaching. When he is properly educated he will get a new resource from his relationships.

It may be difficult to demonstrate this goodness. In the nature of things we must assume it, although we know that we could not subsist on a sphere of the opposite qualities. The important consideration is that we appreciate it, and this not in any sentimental and impersonal way. To every bird the air is good; and a man

knows it is good if he is worth being a man. To every fish the water is good. To every beast its food is good, and its time of sleep is good. The creatures experience that life is good. Every man in his heart knows that there is goodness and wholeness in the rain, in the wind, the soil, the sea, the glory of sunrise, in the trees, and in the sustenance that we derive from the planet. When we grasp the significance of this situation, we shall forever supplant the religion of fear with a religion of consent.

We are so accustomed to these essentials—to the rain, the wind, the soil, the sea, the sunrise, the trees, the sustenance—that we may not include them in the categories of the good things and we endeavour to satisfy ourselves with many small and trivial and exotic gratifications; and when these gratifications fail or pall, we find ourselves helpless and resourceless. The joy of sound sleep, the relish of a sufficient meal of plain and wholesome food, the desire to do a good day's work and the recompense when at night we are tired from the doing of it, the exhilaration of fresh air, the exercise of the natural powers, the mastery of a situation or a problem—these and many others like them are fundamental satisfactions, beyond all pampering and all toys, and they are of the essence of goodness. I think we should teach all children how good are the common necessities, and how very good are the things that are made in the beginning.

It is Kindly

We hear much about man being at the mercy of nature, and the literalist will contend that there can be no holy relation under such conditions. But so is man at the mercy of God.

It is a blasphemous practice that speaks of the hostility of the earth, as if the earth were full of menaces and cataclysms. The old fear of nature, that peopled the earth and sky with imps and demons, and that gave a future state to Satan, yet possesses the minds of men, only that we may have ceased to personify and to demonize our

fears, although we still persistently contrast what we call the evil and the good. Still do we attempt to propitiate and appease the adversaries. Still do we carry the ban of the early philosophy that assumed materials and "the flesh" to be evil, and that found a way of escape only in renunciation and asceticism.

Nature cannot be antagonistic to man, seeing that man is a product of nature. We should find vast joy in the fellowship, something like the joy of Pan. We should feel the relief when we no longer apologize for the creator because of the things that are made.

It is true that there are devastations of flood and fire and frost, scourge of disease, and appalling convulsions of earthquake and eruption. But man prospers; and we know that the catastrophes are greatly fewer than the accepted bounties. We have no choice but to abide. No growth comes from hostility. It would undoubtedly be a poor human race if all the pathway had been plain and easy.

The contest with nature is wholesome, particularly when pursued in sympathy and for mastery. It is worthy a being created in God's image. The earth is perhaps a stern earth, but it is a kindly earth.

Most of our difficulty with the earth lies in the effort to do what perhaps ought not to be done. Not even all the land is fit to be farmed. A good part of agriculture is to learn how to adapt one's work to nature, to fit the crop-scheme to the climate and to the soil and the facilities. To live in right relation with his natural conditions is one of the first lessons that a wise farmer or any other wise man learns. We are at pains to stress the importance of conduct; very well, conduct toward the earth is an essential part of it.

Nor need we be afraid of any fact that makes one fact more or less in the sum of contacts between the earth and the earth-born children. All "higher criticism" adds to the faith rather than subtracts from it, and strengthens

the bond between. The earth and its products are very real.

Our outlook has been drawn very largely from the abstract. Not being yet prepared to understand the conditions of nature, man considered the earth to be inhospitable, and he looked to the supernatural for relief; and relief was heaven. Our pictures of heaven are of the opposites of daily experience, of release, of peace, of joy uninterrupted. The hunting-grounds are happy and the satisfaction has no end. The habit of thought has been set by this conception, and it colours our dealings with the human questions and to much extent it controls our practice.

But we begin to understand that the best dealing with problems on earth is to found it on the facts of earth. This is the contribution of natural science, however abstract, to human welfare. Heaven is to be a real consequence of life on earth; and we do not lessen the hope of heaven by increasing our affection for the earth, but rather do we strengthen it. Men now forget the old images of heaven, that they are mere sojourners and wanderers lingering for deliverance, pilgrims in a strange land. Waiting for this rescue, with posture and formula and phrase, we have overlooked the essential goodness and quickness of the earth and the immanence of God.

This feeling that we are pilgrims in a vale of tears has been enhanced by the wide-spread belief in the sudden ending of the world, by collision or some other impending disaster, and in the common apprehension of doom; and lately by speculations as to the aridation and death of the planet, to which all of us have given more or less credence. But most of these notions are now considered to be fantastic, and we are increasingly confident that the earth is not growing old in a human sense, that its atmosphere and its water are held by the attraction of its mass, and that the sphere is at all events so permanent as to make little difference in our philosophy and no difference in our good behaviour.

I am again impressed with the first record in Genesis in which some mighty prophet-pœt began his account with the creation of the physical universe.

So do we forget the old-time importance given to mere personal salvation, which was permission to live in heaven, and we think more of our present situation, which is the situation of obligation and of service; and he who loses his life shall save it.

We begin to foresee the vast religion of a better social order.

The Earth is Holy

Verily, then, the earth is divine, because man did not make it. We are here, part in the creation. We cannot escape. We are under obligation to take part and to do our best, living with each other and with all creatures. We may not know the full plan, but that does not alter the relation. When once we set ourselves to the pleasure of our dominion, reverently and hopefully, and assume all its responsibilities, we shall have new hold on life.

We shall put our dominion into the realm of morals. It is now in the realm of trade. This will be very personal morals, but it will also be national and racial morals. More iniquity follows the improper and greedy division of the resources and privileges of earth than any other form of sinfulness.

If God created the earth, so is the earth hallowed; and if it is hallowed, so must we deal with it devotedly and with care that we do not despoil it, and mindful of our relations to all beings that live on it. We are to consider it religiously: Put off thy shoes from off thy feet, for the place whereon thou standest is holy ground.

The sacredness to us of the earth is intrinsic and inherent. It lies in our necessary relationship and in the duty imposed upon us to have dominion, and to exercise ourselves even against our own interests. We may

not waste that which is not ours. To live in sincere relations with the company of created things and with conscious regard for the support of all men now and yet to come, must be of the essence of righteousness.

This is a larger and more original relation than the modern attitude of appreciation and admiration of nature. In the days of the patriarchs and prophets, nature and man shared in the condemnation and likewise in the redemption. The ground was cursed for Adam's sin. Paul wrote that the whole creation groaneth and travaileth in pain, and that it waiteth for the revealing. Isaiah proclaimed the redemption of the wilderness and the solitary place with the redemption of man, when they shall rejoice and blossom as the rose, and when the glowing sand shall become a pool and the thirsty ground springs of waters.

The usual objects have their moral significance. An oak tree is to us a moral object because it lives its life regularly and fulfils its destiny. In the wind and in the stars, in forest and by the shore, there is spiritual refreshment. And the spirit of God moved upon the face of the water.

I do not mean all this, for our modern world, in any vague or abstract way. If the earth is holy, then the things that grow out of the earth are also holy. They do not belong to man to do with them as he will. Dominion does not carry personal ownership. There are many generations of folk yet to come after us, who will have equal right with us to the products of the globe. It would seem that a divine obligation rests on every soul. Are we to make righteous use of the vast accumulation of knowledge of the planet? If so, we must have a new formulation. The partition of the earth among the millions who live on it is necessarily a question of morals; and a society that is founded on an unmoral partition and use cannot itself be righteous and whole.

—*The Christian Rural Fellowship Bulletin No. 1.*

WHAT IS LAND?

BY O. S. MORGAN

The definition of land is superficially simple. In plain words it is the solid as opposed to the fluid part of the earth's surface. In the countryman's thought it is the basis for producing plants and animals, for producing food, fuel, clothes and shelter. In the city man's thought land is the site and location basis of city enterprise. Land thus conceived is essentially area, length and breadth.

When we dig into the farmer's off-hand conception of land, the case is not so simple. Eventually he comes to fair agreement with the economist and the sociologist that land as he uses it is essentially all nature; namely, three-dimensional. That is, in the words of Professor Yoder, "Land includes not only the surface of the earth, but also what is below and above the surface—soil ingredients, minerals, rainfall and temperature."* This is merely a step from Ricardo's definition of land as "the original and indestructible powers of the soil." That is, land is a gift, besides being of fixed area. Henry George states: "The term land embraces...all natural materials, forces and opportunities..."† As Blackstone put it: "Land hath also in its legal signification an indefinite extent upwards as well as downwards."‡ Professors Carver and Lundquist state that "Land in its broadest possible sense might be defined as the whole of nature, outside of man and the specific products of his own labour."§ In this broadest sense it is evident that our forebears of the Stone Age farmed the sea, chiefly, instead of the solid surface. Here land was essentially a hunting and fishing ground, with emphasis now on hunting, now on fishing—and no agriculture.

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*Yoder, F. R., Introduction to Agric. Econ., 1929, p. 86.

†Book i, Ch. ii.

‡Comm. 1767, ii, 18.

§Principles of Rural Sociology, 1927, p. 264.

Professor C. L. Holmes states that "When a farmer buys or rents a piece of land, he not only secures the use of a certain area of space and the elements of fertility resident in the soil, but he likewise obtains use of a more or less favourable endowment of climate, slope and general natural conditions."* That is, "the term 'land' (includes) all of the nature-contributed factors of production."† In the 1934 Yearbook of the United States Department of Agriculture, Dr. C. F. Marbut reinforces this agricultural viewpoint of land in referring to land as defined by "...three concepts...climate...relief...soil..."‡.

Land leads the quartette of the four factors considered essential in modern production. Labour, capital and management follow. There is no way of deciding in advance whether or not land is the most important. Given a hungerstalked man with some skill in wringing food, clothing and shelter from land, the first requirement is arable soil, followed hard by capital and labour requirements. As population crowds land resources, the relative importance of the four factors changes depending upon economic, political and social standards.

I agree with my vigorous colleague, Professor Tugwell, when he observes: "I think it fair to say that intelligent use of the land is the first criterion of any civilization." This in my thought means primary emphasis upon management.

Our answer to "What is Land?" will depend in the final analysis upon the attitude we take individually and collectively towards what from one angle is one factor, namely, capital. This capital is nature plus all that man's accumulated wisdom has supplied. That is, it includes the other three—land, labour and capital goods. One type of management of land means drudging, sweating, slaving, fatalistic subsistence; whereas under parallel conditions with capital and management factors transformed by modern techniques land means a high level of living with the farmer's wagon hitched naturally to the stars.

*Economics of Farm Organization and Management, 1927, pp. 132-133.
†*Ibid.* ‡1934 Yearbook, U. S. D. A., p. 329.

Man with twentieth century techniques, according to the Forty-Second Annual Report of the Illinois Agricultural Experiment Station, doubles the yield of continuous cropping with corn by using a simple crop rotation scheme, and trebles the continuous corn yields by rotation backed with intelligent use of fertilizers and lime. "Thus, with poor cropping, nature is a more important factor (56%) than man...Where a good three-year rotation including clover was used, nature was responsible for about one-third of the harvest and man for about (64%) of it." It may be well to temper the pride of man somewhat by quoting Dean Eugene Davenport on this "man and nature" test. He states that "The farmer says, 'I raised this field of corn and one team did all the work.' But while they laboured and while they slept there were at work, for every acre, around .50 invisible and silent horses (sun's energy) which never ate or slept but laboured continuously and without drivers."

Land as soil is commonly looked upon as the chief production agent in farming. But man is chief for he is at the controls. It is man who guides forces to produce the three or four utilities of form, time, place and possession. Sumner and Keller penetratingly observe, "The ultimate elements offered for a scientific study of the evolution of human society are Man and Land"...Shall we have the "vegetable civilization" with population-crowding land as in Egypt, India, Java, China, and Japan? Or, shall we have the machine and the chemical civilization of America and northwestern Europe with land eliminated as a fixed man-land ratio? If the techniques in machinery and in chemistry have for the time being set the fear of national land shortage beyond the bounds of social and political concern, the happy condition has transferred stupendous problems from land questions to geniuses of mechanization and chemical formulation.

As land is meaningless without man, man is undone without land. Land ties in with the entire fabric of man's welfare, begin as you will with Adam or the Neanderthaler. But land as property came, says Professor Gras,"...

so far as evidence is available, in the settled village." Good land may have come first as property of the family, while pasture and woodland of the village. But land was not at first owned by the individual as were jewels, weapons, and clothes. In this early village and family ownership of land lies the urge of reforms to return to common ownership of it in the hope, it might seem, that the future Golden Age lies in excavating the sand-sunk Garden of Eden. Land as property progressed through several stages of ownership before it became free, individual ownership, subject to seizure only by the State.

Land as man's property is subject to the same economic, political, and social distortions as other owned utilities. Since land has become property, it has been taxed. Though I cannot agree with Dr. William J. Hale that "Land by itself has little value," I do agree that from an economic standpoint, "The accursed real estate taxes are primarily responsible for the distressed state of mankind to-day." By manipulation of price land values have been affected. By the control of politics the social welfare of landowners and operators has been complicated. Land tenure is a vital problem to the welfare of State, whether we consider this item historically or currently, whether in the U. S. S. R., in Italy, in Germany, in India among the Tamils, or in Kwangsi, China's "model province." Land tenancy is good or bad as determined by objectives and methods of government and translated by local powers and institutions.

Land is a teacher. Job had come to grips with facts when he concluded, "... speak to the earth and it shall teach thee." We cannot make any sort of attempt to control land but "the still, small voice" makes its impression upon us. The impress is direct as can be. It is perfect if often as unintelligible as was the writing on the wall to Belshazzar. It is patient as a father but as stern as a judge. When the pupil learns the calculus formula of land, he finds that land speaks as supreme law. Having learned this much, law appears now as love. Discovering the law of land sets the pattern for discovering

the Law of God. But I hasten to add that the unvarying law of land refers to nature, not man-made elaborations and institutions. Therefore the teaching dynamic of land (nature) lies, as I grasp it, in its fixity and infinite variety. The active mind in the environment of land, using its free as well as its economic, its direct as well as its indirect goods, can use to the full all the social, aesthetic, religious acquisitions of complex modern society. As our great modern naturalist and teacher, L. H. Bailey, states it: "It is one of the marks of the evolution of the race that we are coming more and more into sympathy with the objects of the external world. These things are a part of our lives."

Land as a cure for the present economic and social disturbance is impossible. If man's attitude, sense of responsibility, to land can be improved, that makes for healing "the hurt of the daughter of my people," not slightly but greatly. But that land, contact with land, private ownership of land, operation of land with predatory motive dominant can regenerate a nation, this to my way of thinking is impossible. Substitute the service motive and thereupon land *use* is healing.

—*The Christian Rural Fellowship Bulletin No. 2.*

Address by Mr. F. L. Brayne, Commissioner, Rural Reconstruction, Punjab, at a gathering of zamindars of Rawalpindi Division during the prize distribution ceremony of the Farmers' Week:—If you want to solve the question of unemployment, if you are anxious to see your homes transformed into paradise on earth, if you desire to lead a prosperous life, if you wish to see the zamindars free from all financial worries and if you want to get out of the clutches of money-lenders, then make a determined effort to educate your women.

FOR THE LAND'S SAKE

BY C. F. CLAYTON

Once upon a time, long, long ago, there lived a man—leader, statesman, prophet—who throughout his life had laboured for the achievement of a great ideal. Now, at the point where the promise of fulfilment of these efforts of a lifetime was at hand, there came to him a voice which said that the end of his days must come without the realization of his dreams. But this man was given the privilege of seeing the tangible evidence of the ideal which he had pursued. From the top of a mountain, which was to be the place of his death, he was permitted to see far off the promised land which had been the goal of his efforts on behalf of his people throughout the years of a long and useful life.

The man who by his vision and labours sought to lead the people of his day into a land of promise, a land glowingly described as one "flowing with milk and honey," was Moses, and the voice that spoke to him was the voice of God.

It is a strange and yet understandable testimony of history that the great dreamers and mystics who have given to the world some of its noblest ideals have lived on the fringes of desert spaces. Much of the history of mankind and much of the wreckage of civilization which history presents to our view may be attributed to that apparent incapacity of man to associate the idealism that appears to flourish in an environment characterized by meagerness of resources with the habits of mind and activities which dominate the life of peoples whose natural environment is rich in resources of climate, soil and minerals.

We can find in the history of our own country the same struggle to associate the idealism of our poets, leaders and statesmen with the practical conduct of our affairs as a people and a nation. America has often been

called "the promised land." We have, however, failed to realize that if America is to be preserved as "the promised land," we must project our social and economic philosophy beyond the thought that the goal has been achieved when the land has been possessed. This people, like that ancient people led by Moses, must face the issue as to what is to be done with the land in order that its beauties may be preserved, its richness enhanced, and its opportunities multiplied. The alternative which we must face is the same as that presented to the ancient civilizations which have preceded us. Whether it is the civilization of Palestine, of Greece, or of Rome, underlying all the superficial facts of their rise and decline is the use which they made of the land resources upon which these and all civilizations must ultimately rest. The record of man's use of land throughout history is a record of abuse, and the teaching of history is that a people which ruins its underlying natural resources writes its own death sentence.

In facing the facts of our own history, we are not, therefore, dealing with an academic or theoretical issue when we recognize that the vast resources in lands, timber, and minerals, with which we were originally endowed, are the basic heritage of this people as a nation, and that provision for the conservation of these resources through economical utilization of them is a sacred duty and responsibility of government.

Misuse of land, at the same time that it undermines or destroys the stamina and virility of the people living upon the land, destroys their basic resource in the land itself. Attempts to cultivate steep hillsides result in rapid erosion, quickly unfitting the land for any use whatever. Tons of soil, a priceless heritage requiring untold ages to accumulate, are annually washed from the hillsides and slopes of farms. "A careful estimate," says the National Resources Board in its recent report (page 15), "indicates that on our crop and pasture land there is an average annual loss of 322,000,000 tons of organic matter, and a net loss of 222,000,000 tons.

Over half of this is due to leaching or erosion. It is estimated that usefulness for farming of 35, 00,00 acres has been completely destroyed, that the top soil has been nearly or quite removed from an additional 125,000,000 acres, and that another 100,000,000 acres are starting in that direction."

Breaking of the original sod has exposed millions of acres of our western grasslands, originally a productive asset, to the agencies of destruction. The protection afforded by the grass cover having been removed, the winds now sweeping across these vast plains annually carry off millions of tons of the top soil of these areas, thus rapidly reducing these vast grazing resources to the sterility of a desert. Attempts to use the land for the production of cultivated crops have failed and are doomed to fail.

This is serious enough in its effects on the lives of the people involved, but more serious still is the rapid destruction of the basic productive capacity of the land, resulting from its misuse. Perhaps the bitterness of economic defeat confronting the familes involved may be repaired, but the tragedy of destruction, if it long continues, will reduce these lands to a state of sterility which will require generations to repair.

In May 1934 Washington and other eastern cities were blanketed by a dust storm which spread over half of the United States. This storm brought to us visible evidence of the destructive effects of wind erosion on vast areas of our unprotected soils. It is estimated that within that portion of the United States lying west of the Mississippi, storm winds annually transport 850,000,000 tons of soil a distance of 1,440 miles. In the same portion of the United States, according to the same estimate, the winds carry solid material ranging in amount from 126,000 to 160,000 tons per cubic mile of air. The density of such storms is illustrated by the facetious story that in the state of Kansas during one of these dust storms, prairie dogs were observed to be digging holes sixty feet above the ground.

We see, therefore, that adjustments in the use of land are vital to the protection of the land itself and of the people occupying the land. It is important, however, to recognize that the benefits of such adjustments accrue not only to the people occupying the poor land but also to the communities occupying the better lands adjacent to these poor areas. Within these poor areas a large proportion of the land is typically delinquent for taxes. At the same time, roads, schools, and other public facilities and services supported by the general community must be maintained for the benefit of the isolated families and groups occupying these poor lands. With extensive tax-delinquency applying to the poor areas, a pyramiding of taxes upon the better lands is inevitable. This pyramiding of taxes tends, of course, to cause the better lands to become tax-delinquent, thus spreading to the entire community the infection originating in the misuse of the land.

Many communities in the United States are disabusing themselves of the idea that the best method of maintaining a permanent source of the public revenue is to keep lands in private ownership and on the tax roll, regardless of the use to which these lands are devoted. They have found that such a policy ultimately results in the creation of situations such as we have described. Far from establishing a source of permanent public revenue, such policies have had the effect of undermining the very foundations upon which the support of public institutions and agencies must rest. It is sometimes argued that to remove these misused lands from the tax roll by converting them, for example, from private to public ownership would have the effect of undermining the source of local governmental revenue. It must be obvious to all, however, that if shifts in the ownership and use of such lands are accompanied by adequate provisions for the establishment of the families involved in better locations, the effect would be not only to improve economic opportunities of these families, thus creating a capacity for the payment of taxes where none existed

before, but also to reduce the per capita costs of supporting schools, maintaining roads, affording fire protection, and similar services which every governmental agency must provide for its citizens, however remote their homes may be. Misuse of land is commonly associated with isolation of families and population groups, and in these situations the per capita costs of maintaining public services are always high, although the services which the community ordinarily is able to provide for such groups usually fall far short of those that are available to the less isolated portions of the population.

In the face of this situation, briefly and inadequately described, can there remain any doubt as to our need for a programme of land-use adjustment, sound in its objectives, national in its scope, permanent in its administration, local in its application? During the past thirty years much has been written and spoken in this country on the subject of conservation and much of real accomplishment has resulted from these discussions. But our programmes have been fragmentary and incomplete, our policies uncorrelated and inadequate.

Among the major achievements of the New Deal, in my opinion, is the foundation which has been laid for a permanent land utilization policy and land-use adjustment programme. The foundations of such a policy have been established through a comprehensive survey of our land resources and land-use adjustment problems made under the direction of the National Resources Board. Supplementing the work of the National Resources Board, a programme of land-use adjustment has been initiated. This programme, national in scope, has been properly launched on a purely experimental and demonstration basis, in order that progress might be measured, results tested, and adjustments in methods and objectives made in the light of practical experience.

Under this programme, the Government is in process of acquiring poor land now predominantly in agricultural use, with a view to converting that land to the use or uses for which it is better adapted. The programme gives

practical recognition to the fact that our original physical resources have seriously deteriorated under a system which permits abuse of the land and impoverishment of families and communities.

The major objectives of the programme include: (1) Conversion of farm land to other uses with the primary objective of eliminating or reducing agricultural production on poor land at a minimum cost; (2) protection and utilization of lands to retard or prevent erosion and to restore the physical productivity of the soil; (3) improvement of the economic and social conditions of families now occupying the lands acquired; (4) improvement of the economic and social condition of "industrially-stranded population groups" occupying essentially rural areas, including readjustment and rehabilitation of Indian population by the acquisition of lands to enable them to make appropriate and constructively planned use of combined land areas in units suited to their needs; (5) reduction of the costs of local governments and of local public institutions and services, while at the same time establishing a more permanent basis of public revenues for local governments by improving the economic situations of families occupying land subject to the local jurisdiction; (6) encouragement of the planned use of rural lands by setting up experimental projects to serve as repeatable demonstrations of types of adjustments applicable to various regions in the United States.

We must recognize, I think, that these immediate and special objectives of the Government's land-acquisition programme are of little import to the future of American life unless the broader implications of the programme are clearly recognized.

In the field of land-use planning, the programme of the Federal Government for the purchase and use of submarginal land provides only a preliminary and experimental approach to the solution of a special phase of the general problem of land conservation and use. Specifically, the present programme applies to those adjustments which

may be effected or facilitated through Federal acquisition of land. In addressing ourselves to the solution of these problems, we should, I think, have courage to accept the risks of experimentation which are involved. No programme sufficiently comprehensive and potentially competent to meet the problems involved can fail to have its hazards, but the hazards of the programme must be faced, unless we are willing to accept the consequences of continued neglect of our land problems. These consequences are no longer of a type requiring exercise of the imagination to visualize. In physical terms, they are presented to us by the spectacles of denuded hillsides, eroded and barren fields, and a wilderness of stumps on lands once covered by the magnificent vistas of our great forests. In economic and social terms, we see these consequences manifested in impoverished families, decadent communities, a mounting burden of public relief, leading in some cases to a breakdown of the entire institutional basis of community life.

To mend this broken fabric of our economic and social life and to regenerate the underlying resources upon which that life depends is a complex and difficult task, but the urgencies of the situation demand that it be undertaken. To embark on such a programme requires, however, that we throw into the discard our notion that these conditions will right themselves if only left alone. We must believe, also, that assistance can be given to the families involved which will provide them with improved opportunities, give to their children a brighter future, transform the lives of these men, women and children from a social and economic liability into an asset to their community, their state, and their nation.

We may feel inspired to risk the experimentation implicit in this task and to challenge the hazards of these new frontiers in the assurance that by so doing we are following in the path of the pioneers who effected the physical conquest of the country and made of us a nation. That path is no longer fraught with the privations and

hardships which were the lot of the old pioneer. The obstacles to be encountered by the new pioneer are spiritual rather than physical. The new pioneer must bring to his task the high courage which has made of the frontier man and woman figures of heroism in the sagas of the old frontier. The beauties of that land which they settled and welded into a nation are celebrated in song and story. Those early settlers of New England could, indeed, say: "We love thy rocks and rills, thy woods and templed hills." And those pioneers who left the eastern seaboard to populate the vast reaches of prairie and plain to the west built their homes in a land more beautiful than that which Moses, looking down from Nebo, beheld in ages gone.

"O beautiful for spacious skies,

"For amber waves of grain—

"For purple mountain majesties,

"Above the fruited plain."

Let it be our task to repair the damage to our lands, our forests, and our streams, to improve and conserve these as a heritage for our children and our children's children. Looking upon the majesty of this vast resource, may they still find in it the primary foundation of human happiness, peace, and contentment which a fertile land provides. May they find that our labours for the land's sake have preserved for them "America, The Beautiful."

The Christian Rural Fellowship Bulletin No. 3.

"The African has a definitely spiritual attitude toward land. It is the gift of the supreme spirit, the mother of the race, the supplier of all temporal needs, a punisher of evil and the abiding place of the departed. It is the intimate link between all generations gone before and the one now living."

Emory Ross

COMMON THINGS

He talked of very common things,
Those days in Galilee;
The things that folks knew all about,
No puzzling mystery.

To men He spoke of vines and corn,
Of seedtime, harvest, too :
Of catching fish and tending sheep :
The work they had to do.

He talked to women of their lamps ;
Of salt and meal and oil,
Of yeast and bread and patching clothes ;
He sanctified their toil.

And now in kitchen or in field
Or in the market place,
We have no echo of His voice,
No glimpses of His face.

O Master, come again to us
In that old simple way !
Touch with Thy grace the commonplace
As in that far-off day !

Floy Lawrence Emhoff

CONSERVING THE SPIRITUAL QUALITIES OF RURAL LIFE

By J. L. Goheen

In these days when the efforts at rural reconstruction are so much to the fore, and when the general thought is that life in the villages needs so much to be made over and reorganized, it is well to stop and consider just how completely this reconstruction needs to be carried out. In all of this uplift work and the improvements pertaining thereto, are there not some factors or features of village life that ought to be conserved? Is everything that has come down to us from the past to be overthrown? Is there nothing to be saved and utilized out of the heritage of centuries of hard-won life? Is it all revolution or is there not much of evolution in this new emphasis on rural life? It is the purpose of this article to deal very briefly with certain highly desirable features of village life that ought not only to be conserved, but also to be utilized and developed to their fullest extent.

First of all there is *The Simplicity of Life in the Village.* There is very little, if anything, that is artificial or non-indigenous in that life. The standard of living needs to be improved but that can be done without injury to or without removing this wholesome simplicity. The insistence upon cleanliness, upon better housing and general living conditions, a proper diet, and more attention to spare-time industries and activities, need not, with care, in any way detract from, but on the other hand enhance and add charm and richness to the simplicity of the village life. In true and wholesome simplicity there can be solid joy and satisfaction. Why then, should not such simplicity be conserved and developed?

Next, there is *The Love of the Soil.* This love of mother earth is found in every country but nowhere more strikingly than in India. Perhaps the chief reasons for it may be social and economic, for the possession of land

gives one a position in the community, and a sense of security. But there is, in addition, a deep-seated attachment for the soil, that which has been handed down from one's fathers and which represents the family's proudest possession and tradition. Whatever the cause, it is a most desirable feature of village life. If only its conservation will mean a deeper care of this valuable possession, and thus help to create the desire to make the best possible use of it, then it certainly will be worth keeping.

Again, there is *The Spirit of Independence*, and this, too, is a most worthy characteristic of rural life. When one is thrown on one's own resources to meet the needs of life, "necessity becomes mother of invention," and one's God-given wits and also physical strength are brought into action. With the present machine-age upon us there may be less cause for this independent spirit and the village may become less self-contained than it formerly was. Still there will be many a challenge to the brain and brawn to meet certain peculiar village needs and conditions. By all means let us conserve and in every way encourage this spirit of independence, and manly self-dependence. How much it can and does add to self-respect!

The Spirit of Industry needs to be conserved and more truly fostered in every village. One hears that the cultivator has from five to six months of idle time on his hands; and consequently laziness and lack of ambition are too much in evidence these days. That may to a certain extent be so, but the true cultivator, who realizes that he has a constant battle to wage against soil erosion, and against the loss of soil fertility, is not the one to be found idle during those five or six slack months of the year. No, indeed, he is the one who is out making bounds and is employing methods to regain, conserve and improve his soil. His ploughing takes place on time, and he is also careful of his cattle, implements, buildings and property in general, and you will find him to the front in community improvements. He is the back-bone of the village, and his example should be used as a stimulant and

inspiration to others. Such a spirit of healthy, happy, full-time industry needs to be nurtured and found more prominent in every village.

Another most important feature of village life that should by all means be conserved, and in every way encouraged is: *The Spirit of Cooperation.* And by that term, cooperation, every form of cooperation, organized, and unorganized, is included. Both have existed in one form or another from time immemorial. The importance of conserving and developing cooperation of every sort is so urgent that it cannot be too highly stressed. Without this spirit of mutual helpfulness there is very little that can be accomplished in the way of rural reconstruction. With cooperation growing, budding, blossoming bearing its life-giving fruit in a village, miracles can be wrought and the whole life and atmosphere of the place changed. Cooperation is the key that will unlock the future prosperity and happiness of the village. It must be employed more and more.

Finally, there is the villager's close *Dependence on Nature and Nature's God.* When the countryside is blessed with ample rain and sunshine, smiling crops greet one on all sides and life is very happy. At such times the villager readily admits that God has been generous and has sent His blessings in abundance. In times of drought and famine there is a crying-out to God for rain and perhaps even superstitious efforts to appease and win favour are resorted to. So perforce, the villager must live close to God. If only his doing so would be more in the nature of holy communion and of humble worship, as an expression of loving obedience to God's will and gratitude for mercies received, then there would doubtless come to the heart of the villager a sense of peace and of joy that can enrich life as nothing else can. After all, God is the giver of life, and of every good and perfect gift, and what a debt of gratitude each individual owes to Him! The villager needs to have this feeling of dependence and holy communion deepened and enlarged. That would be the crowning act in the realization of the Abundant Life that

is his right and his privilege. Does not reconstructed rural India look forward to such life? Why not have it?

The ills and ailments of village life are legion. But there are these splendid qualities of Simplicity of Life, Love of the Soil, Spirit of Independence, Spirit of Industry, Cooperative Spirit, and the Need of, or Dependence on, God that should be retained and cultivated. The first four are perhaps more individualistic, the fifth has to do with one's neighbour-love for one's fellow man, and the sixth indicates one's relationship to God-love for the Creator and Preserver. But all are most essential to the full and rounded development of wholesome and abundant village life. They can easily be preserved and developed in all our efforts at rural reconstruction. In fact, all these qualities are so essential that without their growth and fruitage, rural life will be very barren. Conserving and utlizing them will doubtless introduce the Kingdom of God to Reconstructed Rural India.

—*From News and Views on Rural Reconstruction*, *Sangli.*

"The greatest enemy to the sustained continuance of our American standards of civilization is not an invasion by an armed foe against which we spend vast sums in preparedness, but soil erosion. This enemy is entrenched within our borders. It must be conquered quickly, or else we will condemn succeeding generations to the low economic standards and poverty that have befallen older nations through wastage of soils by destructive agricultural methods."

W. C. Lowdermilk,

THE BIBLE AND AGRICULTURE

By Sam Higginbottom

Allahabad Agricultural Institute

As a farmer in India I have come to regard the Bible as a new book, larger and better, especially the Old Testament. Cattle raising, sheep and goat herding and agriculture in modern India are in general very much the same as they were in the time of Abraham and Joseph and Moses and Isaiah and of our Lord Himself. I have gained a deeper respect for the Old Testament as I have studied it here in the Orient. I regard the book of Genesis, especially the first two chapters, as one of the most up-to-date and important documents the human race possesses. We have the marvellous account of the creation which describes in non-technical language the mighty work of God. Being only a farmer and not a theologian I have spent little time in considering who wrote these books of the Old Testament or when they were written. I thank God that they are written, and that, for the good of the human race, they have revealed in such clearness the unfolding and enlarging purposes of God, who hath in these days spoken unto us by His Son.

Man's Primacy in Nature.—In the first two chapters of Genesis is stated a principle upon which a continuing, progressive human society may endure. The first command (Gen. I. 28) recorded from Almighty God to man says: 'Be fruitful, and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.' The second part of this marvelous command tells man to 'subdue the earth.' Before man can do this, he must first subdue and discipline himself, only then can he apprehend this marvelous world, which God called 'Good' when He created it. As man obeys this command, he finds that out of its

treasuries of field and forest and mine and quarry and air and lake and river and sea, he can get every material thing in abundance that is necessary for his physical well-being.

Again this command says: 'Man shall have dominion over the fish of the sea, the fowl of the air and every living thing that moveth upon the earth.' For practically all my working life (over thirty years) I have been face to face with a civilization, a religion and a philosophy which denies this statement of Genesis. The Hindu pilgrims on the long, weary, dangerous marches to the source of the Ganges, and to the other shrines, far back in the snows of the Himalayas, where food is very difficult to get and very expensive, worship the sacred fish. All along the way in the beautiful hill streams and rivers, well-stocked with fish, one can see the pilgrims feeding the sacred fish and bowing down to them, yet often in great physical hunger themselves.

The Concept of the Family.—The last part of the second chapter of Genesis (2:24) says: 'For this cause shall a man leave his father and his mother and cleave to his wife, and they shall be one flesh.' All thoughtful people the world over realize that the home is the basic institution in any civilization. As the home is, so will the civilization be. Different civilizations have tried different ways of establishing the home. Some have tried to build the home with polygamy and concubinage, a double standard, one for the man, another for the woman, but degrading to woman, and therefore in the last analysis, degrading and harmful to man. Other civilizations have developed what is known as the joint family system, where the daughters are given in marriage, and go out from their father's house but all the sons marry and bring their brides into their father's house. The mother of the sons rules within the home. Very frequently the daughters-in-law have an unhappy time. The suicide rate of wives in the joint family system is about as high as in any society anywhere.

Agrarian Leaders and Prophets.—I would point out that almost all the great characters in the Old Testament were intimately related to the soil. Abraham and Lot had their flocks and herds. Jacob and Moses knew what it was to be out under the stars watching herds and flocks of cattle, camels, sheep and goats. David, before he became king, for the protection of his flock, had fought and killed wild beasts. The most beautiful Psalm in that whole wonderful collection, describes the relationship of the shepherd to the sheep, drawn directly out of the life the psalmist lived. This figure of the shepherd is used by our Lord Himself. One of the most beautiful teachings of our Lord is that He is the Good Shepherd. Not only were the prophets familiar with animal husbandry, they were also familiar with the growing of grain. They ploughed their fields, they kept orchards and vineyards. They knew what to do to make the soil produce. They knew the uses of cultivation and manures. They knew the value of irrigation water. The striking figure of the 'water of life' is taken directly from water poured on dry soil, bringing it to life and productivity.

Is there in any modern literature such a concise, complete and true statement of the causes of depression as Haggai gives: 'Ye have sown much and bring in little; ye eat, but ye have not enough; ye drink, but ye are not filled with drink; ye clothe you, but there is none warm; and he that earneth wages to put it into a bag with holes.'

Sound Economic Planning.—It may not be out of place in these days of depression with the consequent train of suffering, poverty, and loss, to remind ourselves that the Old Testament clearly teaches that godliness is profitable for all things. 'If ye walk in my statutes and keep my commandments and do them, then will I give you rain in due season, and the land shall yield her increase and the trees of the field shall yield their fruit. And your threshing shall reach unto the vintage, and the vintage shall reach unto the sowing time; and ye shall eat your bread to the full, and dwell in your land safely.' (Lev. 26.34.5.) And 'The plowman shall overtake the

reaper, and the treader of grapes him that soweth seed.' (Amos 9. 13). In the Ganges valley to-day, farm holdings are small, on the average less than three acres. The farmer and his family are not gainfully occupied on their farm for more than an average of sixty days throughout the year. What they produce in those sixty days has to support them for three hundred and sixty-five days. This is one great reason for India's poverty. The farm produce of wheat, rice, barley, beans or peas usually takes from ten days to two weeks to thresh under the feet of the oxen. There follows enforced idleness for three months. Hence what a marvelous picture those two passages give us. The harvest is so great that threshing occupies all the time of the farmer between the time of harvest in April or May to the vintage in June and July, and from the vintage to the sowing in September and October. This means fairly steady employment for most of the year, and consequently better economic conditions—'Bread to the full.' Joseph in times of plenty collected the grain into storehouses, saving it for times of scarcity. This kept the prices from collapse, and tended to equalize them. Because of Joseph's foresight, when famine came, not only did prices not rise as high as they otherwise might have done, but many human lives were saved from death by hunger. This is an early record of economic planning. It may be worth studying by those responsible for America's New Deal.

The Science of Agriculture. The prophet Isaiah has many agricultural allusions and references. He is the best farmer in the Old Testament. In the first chapter: 'The ox knoweth his owner, and the ass his master's crib,' reveals his knowledge of animal husbandry. Isaiah (Chapter 28. 24-29) also tells of the preparation of the seed bed and of how different crops are sown and harvested, and like the man of God he is, says: 'For his God doth instruct him to discretion, and doth teach him.' In the thirty-fifth chapter he tells us how the desert shall rejoice and shall blossom as the rose and in the wilderness shall waters break out and streams in the

desert. The beginning of the fifty-third chapter is a description of what we think of as a modern discovery, that is, the so-called dry-farming. Over 2500 years before America knew or understood dry-farming, Isaiah had practised it. 'He shall grow up before him as a tender plant and as root out of dry ground,' is dry farming. Again in 55.10 he says: 'For as the rain cometh down and the snow from heaven, and returneth not thither, but watereth the earth, and maketh it bring forth and bud, that it may give seed to the sower and bread to the eater.' It is as a farmer and not an outsider that he writes. He notices the sequence, the purpose, first of all, to have seed for the sower. Unless we save the seed from this harvest we can have no crop next year. Even before the farmer gives bread to himself, and his children, he makes sure that his seed is secure for the next harvest.

The Rural Craftsman. I wish to call attention to our Lord and His relation to agriculture. The belief of the church that our Lord was a carpenter is based upon two rhetorical questions: 'Is not this the carpenter's son?' (Matt. 13.55,) and 'Is not this the carpenter?' (Mark 6. 3.) We know that every Jewish boy learned a trade. The Apostle Paul, for instance, in spite of his wealth, education and social standing, had learned tent-making which would permit him to earn his living on occasion if his wealth failed him. So Jesus like other Jewish boys had learned something which would enable him to earn his own living. We know at that time in Palestine, as in many parts of the world to-day, during the time of the preparation of the seed bed and the sowing of the seed, and the reaping and threshing of the crop, that artisans and tradesmen, men, women and children left bench and shop and home and went out to help in the fields. Agriculture is the basic industry of the world. The furrow is the dividing line between barbarism and civilization. So in order to secure an adequate food supply the young and old, rich and poor, men and women, all classes, at the right season forsook all other occupation and went into the fields to help to secure the adequate

and necessary food supplies. So that while our Lord worked as a carpenter, living as He did in the village of Nazareth, He most probably went out and worked in the fields at seed time and harvest. He learned farming thoroughly. This we know because of the familiar and intimate way He speaks of farming.

The Farmer. Many of our Lord's parables are concerned with agriculture. He spoke His parables not as an on-looker, but as one who is actually familiar with and had had practical experience in the thing he was talking about, for example, the parable of the sower, the parable of the vineyard, the parable of the wheat and tares, the parable of the lost sheep. Note the accuracy with which our Lord observed. He said : 'He who puts his hand (not hands) to the plow.' (Luke 9. 62.) The oriental plow has only one handle. The country plow used to-day in India is essentially the same as was used in the time of Our Lord and of Isaiah and of Joshua and Joseph. The plowman needs one hand for the goad, or, in India, for twisting the tails of the oxen. The plow being shaped like the bottom of a boat, if the man holding this plow in his right hand, looks back, the plow is slightly turned and rides out of the ground. It therefore fails to accomplish the purpose for which men plough.

I write this in the hope that it will send more to study the word of God. If men to-day would only take the word of God seriously, and put its teachings into practice in all parts of our life, our ordinary business life as well as our spiritual life, we could then expect to see the new heaven and the new earth—the Kingdom of God here and now among men, for the coming of which our Lord bade us pray.

The Christian Rural Fellowship Bulletin No. 16.

Land is the home of the race, the great mother heart of the world. And from out the land creep the delicate but tenacious tendrils of the soul of the individual African."

—Emory Ross

A GOSPEL OF THE SOIL*

By Malcolm Dana, D. D.

Last summer I found myself speeding over the rails on a Great Northern air-conditioned train, the Empire Builder. The name of the train, together with the comforts within and certain contrasts outside my comfortable car, induced sober retrospect. I had never given it much thought but as a boy, I suppose I was something of a western pioneer. My family moved from Connecticut to St. Paul Minnesota, before there was a railroad west of Twin Cities. I can remember watching "covered wagons" and "prairie schooners," followed by long lines of flocks, herds and people afoot and on horseback, wending their weary way up one of the main streets of that city, very much as Abraham must have gone out of Ur of the Chaldees. Now two other railroads parallel the Great Northern, traversing the hundreds of miles lying between St. Paul and the Pacific coast.

I never tire of looking out from car windows and, gazing upon the speeding landscape, I could but notice all sorts of changes time had wrought upon the face of the land. For I could remember that western country when it was a comparative wilderness, and when its life was essentially pioneer. And I could but ask, as I looked from the train windows: Did the early pioneers play fair with the *soil* lying outside?

Torrid heat and awful drought prevailed in a dozen western states and, like other people, I found myself speculating as to the possible causes. I could not but wonder whether the first settlers did not have much to do with it. Doubtless most of them, like Abraham, did go west looking "for a city which hath foundations, whose builder and maker is God;" for they were an inherently religious people. But did they use rightly the lands

* Radio Talk—WESG, Ithaca, New York, February 16, 1937.

they cleared and farmed, accepting them as a marvellous gift and heritage?

I lived in that western country in the days of "homesteading," and when elemental land-hunger had no difficulty in acquiring "free lands." It was an era of the speculator, the exploiter and the "land shark;" who lured people thither by means of every specious claim and false promise—and for revenue only. And the government apparently aided and abetted them. Its land policies "permitted a rural civilization to grow up virtually without social plan and purpose," and one "characterised by a haphazard and community-less manner of living." Our government has never been a true guardian of the soil. Matchless prairies were everywhere ploughed under, destroying native sods and grasses which can never be restored. The western country had fattened buffaloes, wild horses and cattle, and innumerable game for generations; making it truly a happy hunting ground for its original owners, the Indians. But red men, buffaloes, and soils were ruthlessly slaughtered, and, again, for material ends. All land was for the sowing of crops with little or no thought taken for suiting them to particular regions or soils. Farming itself was for "first values," with no felt obligation to put back into the ground what was taken out of it. The ordinary custom was for a settler to acquire land, use it up, and then move on to repeat the process again and again. Gazing out of my car window, I was forced to look upon a depleted as well as upon a parched and arid countryside; and I could but wonder if we are not now reaping just what we sowed. For only the other day an eminent soil conservationist had said in my hearing that "the worst crimes which America has committed have been crimes against the soil." And another scientist has also affirmed that misuses of land are to blame for "dust bowls" in Texas; and that they also account for the "dust storms" elsewhere, which have blown the finest surface soils the world has ever known from off the very face of the continent. And during very recent days of disastrous floods,

which have destroyed millions of acres of farm lands, as well as hundreds of lives, a like blame has been laid upon holders and users of the soil.

Many people last summer, in the drought-stricken country, were doubting Providence, because of its seemingly cruel treatment of the western farmer. But are fat crops supplied entirely out of hand as the old Hebrew thought, or are they conditioned by man's own use of inexorable laws of the land—laws which even the Creator himself cannot set aside? All of this has lead me to wonder if there is not a Gospel of the Soil which is waiting to be discovered, preached and practiced in rural America.

It seems to me that such a Gospel is being discovered and preached by just such institutions as this New York State College of Agriculture, and by the type of farmer being trained and supplied by them. Let us see just what is coming to pass in the farmer world.

As I looked out of my car window last summer, I was interested to watch the villagers who gathered at the rail-road stations "to see the Empire Builder go through." And it pleased me even more to behold the picturesque cowboys galloping over the open country, astride their wiry pintos or "broncs." But I must confess that I was humbled by a sight of the farmers working their lands in a blazing atmosphere, and under a pitiless sun. It made me almost ashamed of my own luxury and air-conditioned ease. The very contrast, however, set me to thinking over the way those western farmers had come. A large number of those seen from the train doubtless came from foreign lands. But the earliest settlers were mostly from New England, where I was born. Their history is worth pondering from that day to this.

The story of the world farmer must note his development from the hoe farmer, or primitive muscular type, to the modern machine farmer or "cerebral" type. One performed the farm task of "the lift and the carry" by means of the contractile human muscle, or "human engine;" while the other has transferred most of that burden to all sorts of farm machinery. "Between these

two types lies the mass of the land workers in the United States." But it is the truly American farmer that intrigues me most. His development reveals a number of different types, and each one of them is product of a successive epoch in the settlement of rural America.

I could not, of course, recall associations with the earliest type, the Pioneer Farmer, for he lived on the Atlantic coast long before my own ancestors landed upon the shores of Massachusetts. But history and biography are filled with descriptions of the earliest pioneers who pushed out from coast settlements into the unbroken forests, and of later ones who led the van of every advancing frontier. The arduous work of felling the forests, subduing the soil and fighting the Indians, made of the pioneer the hyper-individualist of history. He also became a "traditional farmer," who was "set in his own ways of doing things," which ways he handed down to be imitated by his childre... This type of farmer has always found it hard to realize that "beyond and above individualism there is something higher—mutualism."

After the pioneer came the Householder or Land-farmer. He was busy making the new West, when I came to it as a boy. My memory can recall him. This farmer no longer lived alone, but first with neighbours in a clearing and later upon his own farm. The family became his unit of interest and value instead of the individual, and with him there came into existence "the finest family the world has ever seen"—the American farm family. This farm family has made the greatest biological, sociological, moral and spiritual contributions to the total life of the nation. And with it originated the family-farm, which still persists as characteristic of America.

A third type of farmer to develop was the Speculator and Exploiter, a product of the increasingly materialistic age. Dollars and cents are his passion, and he is absorbed in land prices rather than by real land values; together with the unearned increment. He is also dominated by the get-rich-quick and get-something-for-nothing philosophy of life; and seldom refers to his farm as a home,

but boasts of his lands as worth so many dollars an acre. He represents the era of breaking of home ties, of abnormal drifts to the cities, of abandoned churches, and of loss of neighbourhood. A farm which has supported one family comfortably is made to support two; while absentee landlord and farm tenant consider it a mutual necessity to rob and ruin the land. Speculation and exploitation go hand in hand, and they invariably spoil both the farmer and the soil. This type of farmer is to blame for much of the misery upon farms seen from my car window.

My air-conditioned retrospect may seem to be a gloomy one. But there is a rift in the clouds. A fourth type of farmer is even now in the making. He is the husbandman, who has been described as a farmer who is "married to the land." This farmer treats the soil with much of the consideration shown towards his wife and family; for his unit of interest and value is land itself and after that the whole farmer class that works thereon. The husbandman is coming to believe that while he may hold a legal title to his farm, he does not really own it. For "the earth is the Lord's and the fulness thereof," and all land is holy earth. Therefore, to mine the earth, or to run out the soil, or to leave a farm in worse condition than when it was acquired, is just as much a sin as to break any or all the commands of the Decalogue. For the husbandman feels himself duty bound to think of generations yet unborn who must live on the land after he has done with it. And still further, farming is a copartnership, and even a co-creatorship with God, in their behalf. It is also a partnership between man and the soil, to the end of making the earth yield both her full and rightful increase. Duty demands "putting all parties concerned into the picture," of those who own, work and benefit by the land.

Verily, here is the discovery and practice of something akin to a Gospel of the Soil. All day long, while humming over the rails, that need has haunted me—the need for such a gospel. I asked myself: Is there really such a thing? Where can it be found? As a final pre-

paration before seeking my berth for the night, I turned to a small pocket edition which I carry with me. It was a Bible, which incidentally has an unappreciated rural bias and content; for it rests upon the scientific dictum: "underneath all, the land." The pages opened to the book of origins, and first chapters of Genesis. There I found a vivid picture, whose details certainly give beginnings for a needed gospel of the soil.

The ancient record declares that in the beginning God made the earth, and pronounced it very good. The thrills that I had been experiencing all day long, as I looked out of my car window, were also felt by Jehovah way back at the dawn of creation. And we had been sharing them together. But one sentence in Holy Writ seemed to me to contain a real pathos: "but there was not a man to till the soil." A Negro poet has interpreted that situation: "but God said I am lonely still......I'll make me a man." God wanted a companion. And that companion must be created "in his own image," made "a living soul"; he must be capable of thinking God's own thoughts with and after him—especially those thoughts contained in the beneficent but also inexorable laws of land. God also desired a partner. Nay more, he must have one; for he had started something he could not finish, alone. God might make a world, but he could not till the soil. At this point emerges the sublime dignity and worth of all those who work upon the land. For the very first need felt and voiced by the Creator after he had made the earth and all its animate life, was for a farmer. And this man was to be a co-operator. For without his assistance, the ground would not only refuse to yield its full increase, it would also revert to type. It would return again to primeval chaos, for that is Nature's way when left to her own unaided devices. Man's primary and greatest responsibility, under God, and in behalf of human beings, has always been to care for the earth. Holy Writ declares that he must dress it—plough, harrow, sow, cultivate, and harvest; that he must also keep it—guard it against pests, erosions, ravages by wind

or flood, disasters of heat and cold, and from all wicked misuses and abuses by man.

Here truly is a Gospel of the Soil, which is good sociology and sound economics, as well as religion. Its preaching and practice will secure right care, development and uses of holy earth. For the creative pattern and intent are made evident. Farming is rightly a three-fold co-operative. God, man and the soil are to work together with mutual interest and rights in mind. Each co-operator is absolutely essential to the other, and only a harmonious and efficient working together can vindicate the divine expectation. If one member fails or wrongs the other in this team play on the soil, the destiny of the Universe will not be utterly thwarted. But it will be retarded—and that is sin.

—*The Christian Rural Fellowship Bulletin No. 17.*

HILLSIDE PLOUGHING

Say, ha'ye smelled
  The sweet, fresh furrows of the spring?
Ha'ye heard the mouldboard swish the sod
  Tops de over
  Through the clover?
Ha'ye heard the robins sing?

Say, ha'ye felt
  The smooth pull surge along the trace?
Ha'ye felt the share bite deep and true
  As the horses
  Plod the courses
And the May wind's on your face?

Say, ha'ye watched
  The young buds burst to blossom on the tree?
Ha'ye watched hawks idlin' wide and far—
  Circlin' slower
  Droppin' lower
Till ye could no longer see?

Say, ha'ye called
  The welcome halt, to end the toil?
Ha'ye blessed the ease of ache and strain
  When your'e over
  In the clover,
Startin' homeward from the soil?

—LEICESTER K. DAVIS.

SPIRITUAL AND RELIGIOUS VALUES IN RURAL ART

By Betty Eckhardt *

My first realization of the beauty of my farm home and of the fact that it probably was a very desirable place for a little girl to grow up, came from reading the "Country Girl's Creed," which Jessie Field wrote when she was rural secretary of the Y.M.C.A. It had an amazing effect in making me conscious of the many lovely things in my everyday life. I would like to read it since I am greatly indebted to Jessie Field for my own conception of Rural Art.

A Country Girl's Creed.

I am glad I live in the country. I love its beauty and its spirit. I rejoice in the things I can do as a country girl for my home and my neighbourhood.

I believe I can share in the beauty around me—in the fragrance of the orchards in spring, in the bending wheat at harvest time, in the morning song of birds, and in the glow of the sunset on the far horizon. I want to express this beauty in my own life as naturally and happily as the wild rose blooms by the roadside.

I believe I can have a part in the courageous spirit of the country. This spirit has entered into the brook in our pasture. The stones placed in its way call forth its strength and add, to its strength, a song. It dwells in the tender plants as they burst the seed-cases that imprison them and push through the dark earth to the light. It sounds the nesting notes of the meadow-lark. With this courageous spirit I, too, can face the hard things of life with gladness.

I believe there is much I can do in my country home. Through studying the best way to do my everyday work I

*Miss Eckhardt is State Recreation Specialist, W. Virginia University, Agricultural Extension. This paper was written for the annual meeting of The Christian Rural Fellowship, Dec. 5, 1935. New York City.

can find joy in common tasks done well. Through loving comradeship I can help bring into my home the happiness and peace that are always so near us in God's out-of-door world. Through such a home I can help make real to a'l who pass that way their highest ideal of country life.

I believe my love and loyalty for my country home should reach out in service to that larger home that we call our neighbourhood. I would join with the people who live there in true friendliness. I would whole-heartedly give my best to further all that is being done for a better community. I would have all that I think and say and do help to unite country people near and far in that great Kingdom of Love for Neighbours which the Master came to establish—the Master who knew and cared for country ways and country folks.—*Jessie Field.*

Perhaps there are some of you who haven't heard Lorado Taft's famous story of the summer boarders who went out on the hillside on every clear evening to see the sunset. The little girl who lived on the farm watched them with great curiosity. She had never seen anyone who just sat and looked at the sky! When the boarders found that she was interested, they invited her to go with them. She listened to their exclamations on the variety of colours, the clouds, and the after-glow and finally made this pathetic remark, "You know, we didn't have any sunsets on our farm until you came."

Perhaps one needs to have the disappointment of trying to raise a few plants on a fire escape, or see the sad little inhibited city dogs before one really appreciates the joy of contact with flourishing and virile plant and animal life.

A few days of inflicting repressions on children in a city apartment or on the streets should send country dwellers home with a feeling of greater satisfaction in even the simplest kind of cottage where a child can grow up naturally with a wealth of freedom, fresh air, and sunshine.

We sometimes feel that rural neighbours are a bit too curious. We would welcome their interest and kindly

feeling, however, after living in an apartment where no one wants to get acquainted, or cares whether you live or die.

We have gone a long way in this discussion of the art of living without giving a formal definition of rural at. I like the one Allen Eaton gives in his essay on "Woodpiles and Haystacks." "Art is the doing, in the very best way, of the thing that needs to be done." With such a broad definition, we might include not only the building of a fine woodpile, or a haystack, but the ploughing of a field, the growing of a splendid pumpkin, or a fine herd of cattle, or a flower garden, or the making of an apple pie. Country people are supremely fortunate in their opportunity to create beauty. It will add much to the joys and satisfactions of their lives if we can help them realize that they are very near to the Creator, and have the privilege of making possible the expression of the most fundamental laws of life.

Perhaps some of you are wondering what bearing all of this sentiment may have on the general theme of "Rural Reconstruction." I will admit that it is a bit difficult to appreciate the bloom on peaches when they are selling for less than cost of production, or to get very enthusiastic about "farming as a way of life" just before a tax sale. The magnificent progress which the present administration has made towards planned agriculture should greatly reduce the number of economic tragedies.

The attention to the material side of agriculture is, of course, of great importance, but agricultural leaders must be reminded that prosperity alone will not bring happiness. Satisfactions come not from the amount of money we have to spend, but from our capacities for enjoyment in a varied field. There must be sufficient economic success, of course, to give a feeling of security and a reasonable standard of living. The need of increased income past this point diminishes, however, when people learn to find pleasure in simple things and realize that greater satisfactions come from active participation in leisure time pursuits rather than in spending money for

the passive commercial types. Of course, there must be a balance between the two. It would be folly to miss the good things that come to us over the radio or in the motion picture halls just because they are commercial. It is certainly reasonable, however, to expect a person who has had a part in a play to more truly appreciate a fine piece of acting, or for a person who toots a horn to understand a fine symphony. We need many more amateurs in order to appreciate our professional artists. Country people have many talents in the broad field of art, which would give them greater satisfactions and happiness if they were encouraged to cherish and develop them.

There is an old Jewish description of immortality in which the prophet promises that "the righteous will live in a hundred different worlds." Surely that is the contribution that the development of rural art can make to the religious and spiritual life of country people who are particularly blessed by their environment. If we can develop our own potentialities and live as beautifully and completely as a bird or a flower, a tree or a fine animal; if we can encourage this development and the expression of every possible talent and worthy interest on the part of our country people, then we will approach "the abundant life" and truly live in a "hundred different worlds."

—*The Christian Rural Fellowship Bulletin No. 8.*

"The world is strewn with ruins of once flourishing civilizations, destroyed by soil erosion, particularly in Syria, Turkey, and China. But these lands were cultivated for thousands of years before abandonment was necessary. Fifty million acres of land in the U. S. have been ruined by erosion, and another 125 million have been damaged."

THE SOIL BUILDER

By Angus McDonald

Our farm was one of the poorest and hilliest in eastern Oklahoma. The old man called it his rock and air farm. The old man was a fanatic. He was a fanatic on soil conservation. He was always telling his neighbours how they should plough their crops and they were always laughing at him. They laughed at him because he was a preacher and he was telling them how to farm. He had queer ideas about the way to plough in dry weather, about hillside ploughing, about building dams in the gullies and draws, and about conserving the soil in other ways.

The old man was a fanatic about the land. He was always talking about Jefferson and his great agrarian philosophy of government and about Jefferson as conservationist. "The soil," the old man said, "is the backbone of the Nation. If the soil washes away, the country will go to rack and ruin." The old man built dams all over his washy hillsides.

I remember the old man built his dams very carefully. He would instruct the hired man how to place the rocks, and then, after the dam was built, tear it out and build it over to suit himself. He would put a rock in place, "hist" his foot on the wagon hub and give us a lecture on the soil. "When the soil is gone, the country will go to rack and ruin." Then he talked some about Jefferson and then some about Scotch contour ploughing. But nobody listened. What was the use, when we had heard it so many times.

His Method

"You must always make a solid wall of rock across the gully," the old man said. "Fit the rock together and use the big ones first. Then back of the wall put the small rocks up the hill as an approach. For a small gully

a two foot approach is enough. The little rocks should be filled in until they are almost level with the top of the rock wall. Then heavy gravel or fine rock should be spread over the approach as a finishing coat." We often tried to slight our work and throw the rocks in any way. But he would see us and make us do it over again. Will said that the old man watched us out of the corner of his eyes so much he was going blind.

The old man used a peculiar kind of hillside turning plough which he had invented or gotten somewhere. I have never seen one like it. There was a bolt and slide which turned the blade so that in turning land he could come back in the same furrow without going up and down the hill.

Aerating the Soil.

Frequently when breaking land the old man used what he called a subsoiler. He ran this in the furrow behind the turning plough. A long keen bull tongue was attached to a Georgia stock. He said that this let the air get down into the soil better.

"Cotton," the old man said, "has ruined the South. It has impoverished both the land and the farmer. I am proud," he said, "that I have never raised a stalk of cotton." The old man believed in raising lots of feed crops, particularly legumes and keeping plenty of stock to enrich the land with their manure. He said that the farmer who bought his feed was a disgrace to civilization. The farmer should raise everything he eats except sugar and coffee. All the farmers around let the ground near the fences and in the corners go to waste. He used every square foot of his land. He said that the richest soil was next to the fence because it had never been abused by agricultural butchers.

To begin with, our farm was one of the poorest and hilliest in the country. "You can't raise corn on that land," the neighbours said. "May be not the first year but you wait. I'll build it up." "What do you mean, build it up? That land is 'pore' and thin," the neighbours

said. Well, the old man went on building his dams and after two or three years, the neighbours admitted his crops were better than theirs.

Soil Feeders

On the very thin land that had much slope he set out Bermuda grass. On all the cultivated land he planted cowpeas, peanuts, and other crops that he said would enrich the soil. He never laid by his corn without sowing cowpeas unless he already had them in rows between the corn. About the next to the last cultivation sometimes he would put a row of peas in the middle. On especially thin land I 've seen him plant alternate rows of peas when he planted corn. The corn rows would be eight or nine feet apart and have one or two rows of peas between. He rotated his crops a great deal. His land never had corn on it more than once in three years. He had it all figured out that he would put more into the soil than he took out. He was the only farmer around that got two crops a year off his land. We sowed oats in February, harvested in June, and the old man, no matter how dry it was, would always break the ground as soon as the stock had cleaned up the waste grain. Then he would plant cowpeas or some other leguminous crop. He was always cultivating in dry weather. He said that it helped to hold the moisture and the ground would soak up more and there wouldn't be so much run-off if the ground were broken. The old man claimed the reason he made such good yields of corn was because he plowed it every eight days in dry weather. All the old farmers waited for a rain before they ploughed. They laid by their corn when it was about waist high but I 've seen him cultivate his twice after it was in silk and tassel. The other farmers laid by their corn with solid sweeps that cut the roots but he began using buzzard and open sweeps after it was up any height at all. The big buzzard sweeps that he used on a double shovel stock to lay by with hardly stirred the ground over half an inch deep.

His Theory.

He had a theory about conserving the moisture which took him about an hour to explain. I remember that I used to talk to Will when he got started on it but the old man was deaf and never paid any attention. He said that the capillary continuity must be broken to keep the soil from drying out.

There were only twenty acres in the old man's original farm. I remember he had rock walls nearly all around his back land. These weren't gully dams; they were just walls around the fences. I remember one side of his farm was about three feet higher than the land next to it. The old man used to stand by the wall and look down upon the adjacent ten acres. There was a big gully that seemed to start from nowhere just below our land. There weren't any gullies on our side at all. Just two long slopes that ran together and formed a draw in between. About every one hundred feet up the draw there was a rock dam. The silt and sand had filled in above the dams until it was six or eight inches higher than below.

The old man used to stand and look at that big gully below our land. He always seemed to get angry when he looked at it. The gully was five feet deep in some places, I guess. It ran about fifty yards from the edge of the ten acre field. The land between the gully and the fence had grown up with sassafras, red oak, and hickory bushes, and there were some blackberry thickets in some places. The rest of the land was in cultivation and was streaked with a few little gullies but most of it was nearly flat and the soil was reddish yellow. The oldman said it was an example of what sheet wash would do. It finally got so the old man would wander over to that side of the field and look at the gully and the washed land more and more. One day he climbed over the fence and stamped up and down between the rows of stunted cotton and began talking to himself. I heard him mutter something about the foundations of civilization being undermined. I thought probably he was getting up one of his sermons.

Reclamation Begins.

It was not long after this that the old man bought this adjacent ten acres. One of the neighbours told me that he had given two prices for it. I have never seen anybody work so hard as the old man did that year. He had the bushes all cleared off the new land in no time. Then he started to work on the gully. Will told me he was going to quit. He said he wasn't going to kill himself for no dollar a day. We hauled rocks by the wagon-load and built great walls of rock across the gully. Then the old man filled in behind with brush, blackberry-vine stems and little rocks. Behind the initial wall he laid heavy tow sacks. I had never seen him take so much care. Along by the fence he had a ditch dug to take care of the surplus water.

Right after the dams were completed a big rain came and the water tore holes in the dams in several places. But the old man was out early the next morning and put all the rocks in place and strengthened the weak places.

He planted the poor part of the field in cowpeas, had us pick the peas when they were mature and then turned the vines under. In three year's time you would'nt have known it was the same ten acres. The gully was nearly filled up and we were ploughing over it. All the rows of of the forage crops were run on the contours of the slope and there was little or no wash even during big rains. The soil looked darker and every year the yields were larger than the preceding one.

The old man died in 1924. I went to the funeral service in a church in Fort Smith where once he had been the pastor. The minister told what a good man he was and how many souls he had saved. He didn't mention the soil he had saved.

—*The Christian Rural Fellowship Bulletin No. 18*,

Our Former Students.

To

THE CONVENER,
OLD BOYS' LOCAL COMMITTEE,
ALLAHABAD AGRICULTURAL INSTITUTE,
Naini, Allahabad.

DEAR MR. CONVENER,

I was immensely gratified to go through the communication y our Committee published in the January issue of the ALLAHABAD FARMER. As a loyal old boy I must offer my sincere thanks for the same. While at the Institute and also as an old boy, I have always felt that we must have an Old Boys' Association. The need of such association cannot be too strongly emphasised, and the fact that alumni of other institutions have thought it fit to organise themselves, fully justifies our adventure.

While I write this I am not forgetting the peculiar difficulties which we will have to face, in order to be successful. In my opinion the difficulties are surmountable. The all-India status of our institution makes it essential for us to have two departments under the same organisation.

I. A strong local association consisting of the members who are residing at Allahabad or neighbouring area.

II. A chain of correspondents throughout India and such other places where our old friends are residing. I am sure we will be able to enlist the support of enthusiastic old boys who would keep us in touch with friends living in that area. I most humbly put the following suggestions for the consideration of your Committee :—

1. We must start a central Alumni fund and contributions may be received from old boys both local and those outside. We need not fix any sum. Our provincial correspondents may help us in raising funds in their respective areas. The money thus raised may be utilised in giving scholarships and other prizes of merit.

2. Let us fix an admission fee. A sum not exceeding Rs. 3 should be realised from their deposit or by

voluntary contributions from the students leaving after their final examinations. Those who have already left may pay this sum while applying for the membership of the Association. Let us also fix an annual fee not less than one rupee. This sum we can either realise (i) by contribution or (ii) by increasing the annual subscription of the ALLAHABAD FARMER and sending a copy by V. P. P. It will be admitted that our FARMER will play an important part in our enterprise. I will go further and suggest a special annual number styled as Alumni Number of the FARMER. It is up to the staff and the management of the FARMER to help us in this matter.

3. We must form a local Executive Committee elected by the Old Boys present at the annual social gathering. It should also have the Principal and the President of the Students' Union as ex-officio members of the Committee. This Committee will be responsible for conducting the affairs of the Association according to the desire of the general body. It will be responsible to the Association for accounts and proper conduct of the business through (i) Annual general meeting and (ii) through the columns of the ALLAHABAD FARMER.

4. Correspondents from amongst the old boys residing in various provinces may be appointed to handle their respective areas and send all necessary information to the central Executive.

Thus I feel we can link local and other members. I am sure your Committee has received numerous better suggestions, but I need not offer an apology for these because in common with other loyal students of our *Alma Mater* I have the burning desire of seeing her prosper. On this depends our own name and fame. Please convey my best wishes to friends at the Institute.

I remain,
Sincerely Yours,
K. P. SRIVASTAVA,
15-148 A. Civil Lines,
Cawnpore.

Book Review

Agricultural Progress of the Punjab

Punjab Economic Board's Report

The Punjab is now one of the richest and most progressive provinces of India and its transformation from the chaos and anarchy of the forties of the last century forms one of the romances of modern Indian history. When the province came under the British in 1849 it was in a very bad way. There were large groups of disbanded soldiery roaming over the country-side, settled occupations were few, cultivation was mostly dependent on a capricious rainfall, and the limited irrigation was from wells or a few inundation channels fed from uncertain riverfloods. The last ninety years have seen amazing changes, of which the greatest has been in the introduction of a system of canals which has now few rivals in the world. These canals have brought abundance to large tracts of arid, dreary land, which now constitute the canal colonies, perhaps the most flourishing agricultural area in India.

The Board of Economic Inquiry, Punjab, has recently issued as its 52nd publication a report entitled *Agricultural Statistics of the Punjab, 1901-2 to 1935-6*", which gives a bird's-eye view of the steady progress in the agriculture of the province. The main section of the book consists fifty-six tables giving annual statistics of the following: the area of the Punjab and its classification into forests, fallows, sown area, culturable waste and unculturable land ; the average rainfall of the province as well as in seven selected districts representing areas of high and low rainfall ; the respective acreages under well-and-canal-irrigation ; areas (and in some cases the out-turn also) of 35 individual crops ; livestock censuses ; land revenue and its incidence per head of population and per cultivated acre ; sales, mortgages and redemption of land ; harvest prices ; and estimates of the total value of the crops produced.

The first part of the report is devoted to an explanation of the tables and in addition contains several useful summaries which give a clear view of the agricultural position in the years dealt with. Although the main statistics refer to the present century, figures have been taken as far back as possible. For example, it is shown that the population has increased from about $16\frac{1}{4}$ millions in 1868 to $23\frac{1}{2}$ millions in 1931, and in the same period the cultivated area has risen from 20 million to 31 million acres; the greatest increase being in the canal-irrigated acreage which has risen from 1.4 million to nearly 13 million acres, a rise of about 805 per cent.

The capital outlay on productive canals (i. e., on those which were constructed to yield a profit) amounted up to 1935-6 to a little more than 33·3 crores of rupees and the net receipts of the Punjab Government from irrigation, both directly in water rates and indirectly in land revenue charged to such lands amounted to 3·99 crores of rupees or 39 per cent. of the total revenues of the Province. The value of the crops sown on canal lands amounted in 1935-6 to 39 crores of rupees. The figures also show that in the thirty-five years since 1901 whenever the Province has had in one year a rainfall of about 35 inches, the next year it has received only about half this amount, i. e., a very wet year has been followed by a very dry.

The aim of the report is to compress within a small compass useful information relating to land and agriculture. The data are at present found in the annual reports of various government departments and it takes much time to look through a number of these volumes to extract figures on any specific topic. At the same time the tables in these reports are at times presented in a manner not easily comprehensible to the ordinary reader. This book is designed for the use of officials, legislators, business men and students; the public will also find much of interest in it since on agriculture depends the future prosperity of India in general and the Punjab in particular. The report may be had from any bookseller for eight annas only.

Meteorological Observations

APRIL, 1937

Date.	Maximum Temper-ature.	Mini-mum Temp.	Mean Temp.	Percentage of Humid-ity.	Pressure of the Atmo-sphere.	Wind direc-tion.	Rain for the day.	Rain since Jan. 1.	REMARKS.
1	92·0	67·0	79·5	42·0	29·5	N.E.	Trace	1·69	Harvesting of wheat.
2	95·0	65·0	80·0	65·0	29·52	E.	Nil	"	"
3	99·0	69·0	84·0	40·0	25·5	Calm	Trace	"	Levelling.
4	97·0	68·0	82·5	42·0	29·46	East	Trace	"	Digging potatoes.
5	96·0	69·0	82·3	57·0	29·48	East	Trace	"	" "
6	96·0	68·0	82·0	39·0	29·52	Calm	Nil	"	" "
7	94·0	62 0	78·0	38·0	29·58	Calm	Nil	"	Sowing of bajra.
8	99·0	59·0	79·0	40·0	29·56	E.	Nil	"	Harvesting of wheat
9	99·0	66·0	82·5	29·0	29·52	E.E.S.	Nil	"	" "
10	100·0	68·0	84·0	44·0	29·50	Calm	Nil	"	" "
11	100·0	66·0	83·0	34·0	29·52	S.W.	Trace	"	Harvesting of wheat, potatoes and other vegetables.
12	99·0	67·0	83·0	32·0	29 54	E.	Nil	"	
13	101·0	66·0	83·5	29·0	29·48	Calm	Nil	"	
14	100·0	69·0	84·5	28·0	29·48	Calm	Nil	"	Threshing, winnowing and storing barley.
15	104·0	70·0	87·0	28·0	29·48	E	Nil	"	
16	107·0	74·0	90·5	26·0	29·44	E	Nil	"	
17	105·0	76·0	90 5	27·0	29·44	S.E.	Nil	"	Fallow ploughing.
18	108·0	78·0	92·5	27·0	29·46	E.	Nil	"	" "
19	105·0	76·0	90·5	28·0	29·47	W.	Trace	"	Threshing of wheat, mustard and lin-seed.
20	101·0	77·0	89·0	26·0	29·48	S.E.	Nil	"	
21	100·0	74·0	87·0	28·0	29·49	S.	Nil	"	
22	103 0	73·0	88·0	31·0	29·48	S.	Nil	"	
23	104·0	71·0	87·5	34·0	29·44	W.	Nil	"	
24	105·0	76·0	90·5	37·0	29·4	S.W.	Nil	"	
25	104·0	72·0	83·0	31·0	29·31	E.	Nil	"	
26	104·0	72·0	88·0	30·0	29·32	S.W.	Nil	"	
27	102·0	74·0	88·0	32·0	29·34	W.	Nil	"	
28	106·0	66·0	86·0	33·0	29·42	W.	Nil	"	
29	104.0	68·0	86·0	33·0	29·42	S.W.	Nil	"	
30	106·0	69·0		29·0	29·38	W.	Nil	"	

MAY, 1937

Date.	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Pressure of the Atmosphere.	Wind direction.	Rain for the day.	Rain since Jan. 1	REMARKS.
1	106·0	61·0	85·0	32·0	29·34	W.	Nil	1·69	
2	102·0	68·0	85·0	30·0	29·34	N.E.	Nil	„	
3	106·0	66·0	86·0	33 0	29·38	E.	Nil	„	
4	104·0	68·0	86·0	30·0	29·36	S.W.	Nil	„	
5	102·0	62·0	82·0	34·0	29·37	N.E.	Nil	„	
6	106·0	68·0	87·0	32·0	29·32	E.	Nil	„	
7	106·0	66·0	86·0	30·0	29·30	N.E.	Nil	„	
8	103·0	77·0	90·0	31·0	29·40	N.E.	Trace	„	
9	102·0	79·0	90·5	40·0	2 ·50	E.S.E.	Nil	„	
10	100·0	76·0	88·0	37·0	29·52	E.	Nil	„	
11	102·0	76·0	89·0	39·0	29 50	S W.	Nil	„	
12	103·0	78·0	90·5	40 0	29·4	E N.E.	Nil	„	
13	106·0	82·0	94·0	32·0	29·3	S E.	Nil	„	
14	108·0	78·0	93·0	30·0	29 30	W.N.W.	Nil	„	
15	111·0	81·0	96·0	27·0	29·35	W.N.W.	Nil	„	
16	112·0	82·0	97·0	29·0	29·4	W.	Nil	„	
17	112·0	84·0	98·0	35·0	29·2	E.S.E.	Nil	„	
18	111·0	82·0	96·5	36·0	29·27	S.W.	Trace	„	
19	108·0	79·0	98·5	59·0	29·25	N.E.	Nil	„	
20	106·0	83·0	94·5	45·0	29·32	E.	Trace	„	
21	106·0	84 0	95·0	35·0	29·36	N.E.	Trace	„	
22	107·0	84·0	95·5	42·0	29·3	S.E.	Nil	„	
23	106·0	83·0	94·5	38·0	29·34	E.	Nil	„	
24	106·0	84·0	95·0	36·0	29·32	N.E.	Nil	„	
25	108·0	78 0	93 0		29·30	E.N.E.	·14	1·83	
26	100·5	76·0	88·5	37·10	29·32	N.W.			
27	107·5	77·0	92·5	36·5	29·34	S.			
28	108·0	78·0	93·0	38·0	29·30	N.E.			
29	109·0	80·5	94·5	37 0	29·27	S.W.			
30	110·0	81·0	95·5	36·5	29·25	N.E.E.			
31	110·5	81 5	95·5	37·0	29·21	N.E.			

Another indication of the importance of careful dairy management has been brought out by a recent experiment in the State of Washington, U. S.A., in which a study was made of the methods regularly employed for washing churns in seventeen different creameries. The purpose of the experiment was to find whether or not the method of washing the churns affected the yeast and mould counts of the butter made in these plants. The experiment resulted in finding a positive correlation. The following are the methods used by the seven plants having a consistently low yeast and mould content in their butter:

1. The use of an ample quantity of wash-water amounting to at least one-third to one-half the capacity of the churn.

2. A high temperature of the wash water, preferably 180° to 200° F.

3. The use of 0. 1-0. 2 per cent of washing powder solution gives added protection by assisting in the removal of the grease, improving germicidal powder: and improving the order of the churn.

4. Washing or rinsing with an alkaline crystalline hypochlorite solution of about 50 per cent per million of chlorine together with hot water treatment also insured satisfactory results. Only four plants reported the use of this product, but three of these were among the seven plants with best records.

5. Keeping the hot water in contact with the revolving churn for at least 15 minutes.

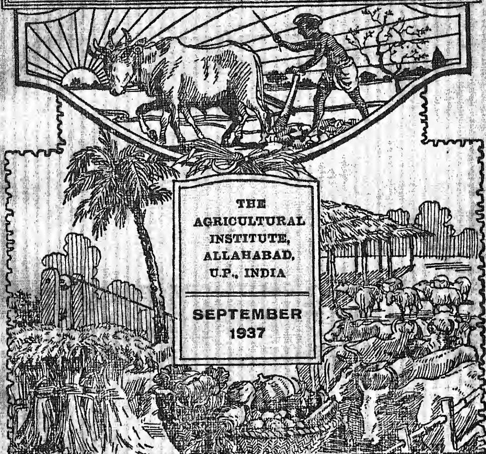
VOL. XI] [No. 5

THE ALLAHABAD FARMER

A bi-monthly Journal

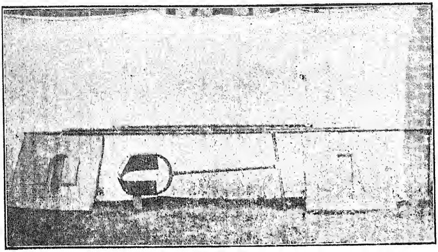
OF

Agriculture and Rural Life



"We have more moral, political and historical wisdom than we know how to reduce into practice; we have more scientific and economical knowledge than can be accommodated to the just distribution of the produce which it multiplies."—SHELLEY.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by 3½ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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Contributors will receive 15 reprints of the article published and additional copies at cost.

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The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
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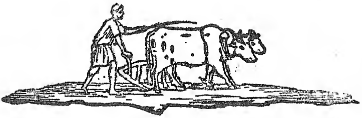
Vo. XI] SEPTEMBER, 1937 [No. 5

Table of Contents

THE
ALLAHABAD FARMER



VOL. XI] SEPTEMBER, 1937 [No. 5

Editorial

The Congress Ministry and the Indian Cultivator.

The sufferings, the burden and the handicaps to which an Indian cultivator is subject to are well-known. The remedies for those ills and the methods of removing them are still imperfectly understood. However the Indian cultivator has been promised that help would come when the Congress takes charge of the reins of the Government. Now that the Congress has accepted office, the Indian cultivator is beginning to be hopeful. Help at last is coming. The decision of the Congress to accept office has therefore been hailed throughout the countryside. The cultivator now hopes that the Congress will do a great deal towards alleviating his sufferings. In order to implement the things which the Congress programme calls for, men with a clear understanding of the problems of the cultivator are needed. But above all, for the solution of the problems of the cultivator, men with a spirit of sacrifice and of service are needed who will devotedly and sympathetically study the problems and evolve remedies for the solution of those problems. It was therefore gratifying to us to note that the premier of these provinces in his speech,

before accepting office, told his hearers that he was the chief servant of the people of the province. That was a new note before the country, although it is not new to us as we have been trying our best to serve this country and to minister to its needs to the best of our abilities. However, the note has been struck. A new attitude is abroad. It is not therefore, too much to hope that the next few years will see some change in the conditions of the toilers of the land who are the backbone of the nation.

* * * *

Agricultural Education in Colleges and Universities.

During the last two or three years there has been a great rush for admission into agricultural colleges. This awakening of Indian students is due mostly to the stimulus given by His Excellency the Viceroy who at all times has been preaching the gospel of better and more scientific farming, the gospel of better methods of raising the cattle of India and of increasing the milk-yield of this country by the raising of better and more nutritious fodders.

The Allahabad Agricultural Institute has had to turn down very many applicants who wanted to get the agricultural training which these young men perhaps feel that this country is in need of. This has happened every year in spite of the fact that the United Provinces has been fortunate enough to have three Intermediate Colleges and two Degree Colleges in Agriculture. Many of the provinces of India however are still without an agricultural college.

In these days of provincial autonomy we hear a great deal of a desire on the part of certain provinces to have their own university. That is a very wholesome desire. But we believe that it would be a mistake to start another group of Arts and Science colleges and call it a university. A provincial university should be one

that will also be represented in its departments all the main industries of the province. A university should include an Engineering College, a Medical College, an Agricultural College and other Colleges whose functions are to solve the problems of the province. An Arts or Science college was at one time good enough for the recruitment of men for the Government machinery. But the demands from a university are now getting more exacting. Each province now looks to its university for proper guidance in all walks of life. Will these new universities meet the needs of the people?

The premier industry of the great mass of the people of India is agriculture. Will these new universities find a place in their curriculum the scientific study of the problems of an agriculturist? We hope so.

* * * *

Mr. A. T. Mosher.

During the year 1936—37 the Allahabad Farmer was very fortunate in getting Mr. A. T. Mosher to occupy its editorial chair. He so ably edited the "Farmer" during this past year that it will be sad news to its readers to know that he has been granted leave for an indefinite period and that therefore during this year he will not be connected with the Farmer. He was, for some years, before he became its editor, also a member of the editorial committee. He is, we understand, planning to spend his study-leave in India, and will occupy himself with the study of the problems of the villages and of the Indian farmer. We hope therefore that he will come back armed with the knowledge that would extend the usefulness of the institution of which he was a member.

TUBE-WELL IRRIGATION

By Dr. Sam Higginbottom.

Principal, Allahabad Agricultural Institute.

Having heard much of the tube-well installations in the Western United Provinces, as a farmer, I was anxious to see some of them at work. I was glad when opportunity came recently to go through the tube-well area in the Meerut district. Mr. Ram Chandra Sahi, the Executive Engineer in charge very kindly acted as guide. We motored in the morning over 100 miles. This tube-well area is one of the outstanding pieces of irrigation work anywhere in the world. The tract we went over is rolling country and would not generally be suitable for canal irrigation. It could not be easily commanded by any of the existing canals, even if there were sufficient new water available. A tube-well can be so located as to be the centre of a small area not capable of being reached by canal. This district, which was formerly very precarious, with poor crops, now has the means of prosperity because of this tube-well irrigation water. The yields of sugar cane and wheat per acre have been almost doubled. Much land which used to be waste and gave the cultivator very little income, is now brought under cultivation and is growing crops which give the cultivators a larger income.

As these tube-wells have been built with public money it is well to know the financial results. I was informed that after allowing for interest on the capital, depreciation and maintenance and running costs these particular tube wells were paying a small profit on the investment. They are not, however, run primarily with the purpose of giving a nett income to Government, but to give the maximum benefit to the cultivator and yet pay expenses.

The system of supplying water to the cultivator has been carefully worked out. The cultivator is the judge

as to when he wants water. He comes to the tube-well and sees the reading of the meter when the water begins to flow on to his land. He also sees the meter when the water is turned off and thus in his presence the amount and cost are known. There is no delay and little chance for mistakes. Because he gets the water by measure, and only takes it when he needs it, he gets water in just the required amount at a minimum cost. He does not take water if there has been a good winter-rain which makes irrigation water unnecessary. Because the tube-well water is sold by measure the farmers are learning to use it much more economically. Last winter, for instance, some farmers actually grew a good crop of wheat with only one watering which cost them Rs. 2-4-0 per acre.

I noticed as I went through this area lucerne, (perhaps the most valuable fodder-crop in the world) was being grown by some of the farmers. This is useful for both oxen and horses, and will undoubtedly lead to much greater prosperity for the cultivators and better fodder conditions for the cattle.

In the afternoon I was taken to see, by the Engineer in charge, Mr. De Cruz, two of the pumping-stations on the Ganges canal. At intervals, for about 20 miles I saw tube-wells that were pumping water into the canal. This means that the canal could supply much more water to cultivators than before these tube-wells were installed. Cultivators at the end of the canal formerly were in a very uncertain position. To the Indian cultivator in this part of India a safe, certain and abundant and cheap supply of irrigation water is the most assuring factor in his cultivation. With such water he is almost certain to get a crop, whereas before he was in terror lest the rains be deficient, in which case he had little or no harvest to reap.

The day began about six in the morning and going and inspecting all the time continued till about four in the afternoon. I have spent few days in India that have filled me more with hope than this one. What I saw in

this tube-well area is positive achievement for the benefit of the poor cultivator.

So far I have spoken only of the direct benefits which are of very great value. But there are other advantages. Before the tube-well came, in many places in this area, the supply of drinking water was inadequate and unsatisfactory, but now wherever there is a tube-well there is an assured supply of good drinking-water for both man and beast. In addition a small plot of land has been reserved round each tube-well and various important crops are being demonstrated and introduced. Again at one place a small swimming tank about 12′ × 20′ and about 3′ deep had been built. This tank was as full of village boys as some of the sacred tanks are full of sacred fish. The boys seemed to be thoroughly enjoying themselves, learning to swim in this beautiful clean water. It is proposed to put in a walled-in-tank for the girls and women. I can think of few better ways to spend Rural Development money than in giving drinking and bathing facilities to the villagers wherever there is a tube-well. Because there is electric power at every tube-well, this could easily become the social centre of the village, a radio receiving set and adult school, demonstrations of better crop varieties and methods.

Since the first tube-wells were put in, the cost of sinking has been greatly reduced; also the cost of the pump and motor. Also it has been found that the area commanded by each tube-well, had been estimated so conservatively that in actual practice many tube-wells command from 30 to 50 per cent. more land than had been estimated for. This makes it that the tube-wells are providing an abundant supply of irrigation water, at a price comparing favourably with that of the canal water. The tube-wells should provide economic security for many who heretofore have not experienced it. The coming of the tube-wells will make this area able to support its own social and medical and educational amenities. In order

(*Continued on page 255*)

WHAT MEN LIVE BY

An address at the opening of term, Allahabad Christian College, July, 1937.

By James C. Manry.

Fellow-students: When I was passing from High school to College, as many of you have recently passed, there was a great deal of talk about education as a preparation for life. That talk had one unfortunate though unintended consequence for many of my generation in that it gave them the notion that they would not begin living until after thay had finished being educated, or that at best they would meanwhile be only half-living.

That is wrong. Education is not only for life, but it is a part of life, and is carried on by living. I have therefore taken my title from one of Tolstoy's short stories, and I shall present some thoughts suggested largely by a book of the same title * written by one of the wisest men I have ever known, that great Christian and great physician Richard C. Cabot. After the Bible, I think any one of you would be well advised to make it your guide in College and after, for what college men and women live by is not something different in kind from what older men and women live by.

Of course there are a great many things that people live by—our life is so marvellously complex. But I shall speak of just four things, which I believe are supremely important. The first of these is Thinking, or Mental Work, or Study. You cannot really live a life that is worthy of man until you have learned to think:

The mind is not a garner to be filled,
But a garden to be tilled.

Professor George Herbert Palmer used to love to tell of an experience he had on commencement at Harvard.

* What Men Live By. By Richard C. Cabot. Houghton Mifflin Company, New York and Boston.

During the preceding semester he had been teaching three times a week on the third floor of a college lecture hall, a course in the history of British philosophy It had been a difficult course, and at the drowsiest hour of the afternoon. But all through the weeks he had been sustained and encouraged, he said, by the bright face of one student on the front row, who kept his gaze rivetted on the teacher. All through the intricacies of Locke, Berkeley and Hume Professor Palmer was comforted by thinking that at least one student was profiting greatly. And then on the afternoon of Commencement Day the door-bell rang and Professor Palmer, answering it, found that student on the step. He came, he said, because he thought he ought not to leave Cambridge without thanking Professor Palmer for all the course had meant to him. Of course Professor Palmer was gratified. Being human, he rubbed his hands together and inquired as to just what aspect of the course it had been that had proved most helpful. Then said the student, "I have to confess I did not understand much of what you said. I cannot remember very much of the course. But one afternoon—you told us that John Locke said we ought to have clear ideas. That has been a very great help to me. "Yes," said Professor Palmer, "if he really got that firmly in mind, it was not such a poor showing."

But the ideas must not only be clear, they must be relevant.

In a Middle Western College two girls just graduating were going back over their four years in college and comparing impressions. One would say, "I liked this"; the other, "I liked that." Then one asked, "How did you like logic?"

"What was that?"

"Oh, don't you remember, in our freshman year, over in the corner of East Hall?"

"No."

"Don't you remember, the course in which we learned all about syllogisms, analogy, hypotheses, and things like that?"

"No."

"Don't you remember the course in which we studied that little blue book?"

"Oh, that little blue book? Was that logic? Yes I remember that."

The ideas must be clear; they must be relevant; and they must be our own. We learn to think by thinking. That means thinking for ourselves, and being prepared to run some risk in doing so.

Just now the world is full of people in Germany and Italy and also elsewhere—who have grown tired of thinking for themselves, and who have handed over their minds to the keeping of some supposed authority, who tells them what to think.

Bernard Shaw in "Fanny's First Play," which is a play within a play, in the final scene places a number of dramatic critics on the stage to discuss the play, by an anonymous author, which had just been performed. The first critic whose opinion was asked complained: "You don't expect me to tell whether it's a good play or not unless I know who the author is, do you?" "If it is by a good author, it's a good play, naturally."

I remember talking to a graduate student at an American university—the name of which I shall not mention, for to do so might suggest that this story is of something distinctive of that university. This student said that along with other graduate students he earned a modest stipend by writing some of the reviews of books for a learned journal published by the university. He said that the method these students followed in writing their reviews was to look up in the back files of their journal the name of the author whose book they had to review. If there was something by him previously reviewed, they would note whether that was favourable or unfavourable, and make their own review fall into line. If it was a new author entirely, they had to go to the labour of taking a stand themselves. But in general they were

unfavourable to new authors, since it was safer to be critical of those whose reputation was not established.

That is, I fear, to some extent the way with all of us in our lazy moments: we like to have labels as a substitute for thought. But in proportion as we give in to this tempation, we cease in that degree to live mentally.

Even in your college days you will find all sorts of propagandists ready to use you to shout, to march, to wave flags and banners. There is only one Leader who has a right to command you following all the time and everywhere, and He does not ask you to follow blindly or to walk in darkness. But what the world needs is more hard-headed, clear-thinking people who face the future courageously without taking refuge behind worn-out formulas. The world does not need more followers: it has too many already. Don't acquire the habit young!

In learning to think (or to study) you must remember that you are not working for your teacher, and you must not worry as to whether, as the phrase goes, you will get credit for all the work you do. There is a very wise saying by a great Roman Catholic, Father Strickland, that I learned long ago, and have on the wall of my study: "One may do a great deal of good in the world if one does not care who gets the credit for it."

In learning to study and think we must not let our feelings guide us. The old Romans had a proverb, "*Fas est ab hoste doceri*," which may be freely rendered, "Make your enemy your teacher," "Learn from your opponent." That certainly goes against our impulses: we should like to learn only from our friends. But our friends mostly resemble us very much; so much, in fact, that what they have to teach us is limited by our similarities. If there is some movement, some doctrine, some institution, some people, toward which you feel an aversion, that is a good sign that you have something to learn from just that source. Study that movement, or whatever it is, to learn its secret of power. You

may learn a more important lesson there than you can from that which is at the very first blush entirely congenial to you.

A second requirement of real living is play, a hobby, some interest you pursue for its own sake, *apne khushi se*, as the expressive Hindustani puts it. Most of us most of the time would feel no hesitancy in answering the question, "Are you working or playing?".

But the very same activity may be work for one man and play for another. My *mali* digs in the garden as work; but that is play for me who spend most of my time indoors over books and papers. It is an unhealthy sign that the masses in the modern world feel such a gulf fixed between work and play. The ideal is to have play—in its power to use all our faculties, take on more and more of the good qualities of work, and to have work—relieved of drudgery—take on more and more of the spontaneity and zest of play. It would be a good thing if sometimes when people ask us, "What are you doing?" we should have to reply, "I'm not sure whether I'm working or playing—it's as pleasant as play, but it's as important as work." I like to hear a sicientist friend speak about "playing around" in his laboratory.

"I know a few rare people who can touch any dull job with a magic which turns it into sparkling play....It is the spirit which we bring with us, not the necessities or laws of nature, which labels certain things work, and others play. Along comes a blithe and bird-like spirit, picks off all the work—labels from monotonous tasks (such as typewriting, book-keeping and chart-making), sticks play-labels upon them all and proceeds to make their new titles good. With such an example daily before my eyes, I am not likely to forget that radiant souls can change the gray of work to the golden-green of play."*

In choosing your forms of play in college days I would suggest that a very useful principle for most of us is to prefer those that you can keep up through your

* What Men Live By, by Richard C. Cabot. pp. 99,

after-life. Some games are too taxing, some too strenuous, some require too many participants, too much space, or too much equipment, to be carried on through life. Prefer the other kind.

But study and play are not the whole story of college days. A third element is affection, or regard for others, friendship in the best sense. This comes when you first recognize other people as persons—valuable in their own right, and not to be treated as mere means to your ends.

Some of us are naturally more gifted for friendship than others, just as some have more native capacity for study. But there is not one totally lacking capacity for friendship, and this is a power that thrives mightily with use.

One of the best achievements of modern civilization is that it has become possible for men and women to be friends as human beings—interested in the same things—with no thought of sex. This will be possible for you anywhere; but more readily so, I believe, in the best co-educational colleges. I am myself a graduate of a men's college; recently I was talking with a woman who is a graduate of one of the best of the women's colleges, Vassar. She was sending for prospectuses of American colleges, and offered to let me see them when they arrived in the mail. I asked her what sort of colleges she was writing to, and she said, "Co-educational only." That shows how one person's mind worked on this problem. There are good colleges for men only, and poor ones; there are good colleges for women only, and poor ones; there are good co-educational colleges, and poor ones. But, other things being equal, a good co-educational college is likely to be better than a good men's college or a good women's college.

In the social life of the colleges there are many organizations, and these elect their officers. In connection with elections and office-holding, I would commend to you a maxim of Benjamin Franklin, "Never seek office; never refuse office; and never resign office." (He was

speaking only of offices with a fixed term, I believe, and would not have opposed retirement on account of old age.)

All the types of affection, fraternal, maternal, filial, conjugal, comradely, are implicit one in the other so that each needs every other, and so that a richer harmony is made by their presence each in each. We are all familiar with the fact that a good wife is fully as much a mother to her husband as she is a wife. She often treats her husband very much like a grown-up son, and is all the dearer to him on that account. If you stop to pursue this familiar thought for a moment, it can lead us far. In the book to which I referred, by Dr. Richard Cabot, he writes of a little girl of seven, who one night was sleeping on an outdoor porch with her mother. As the clouds came up and threatened a storm she awoke before her mother did, and got up to pull the bed-clothes over her mother more securely and throw on the waterproof sheet that was kept there for such occasions. While she was doing this, the mother, had awakened, heard the little girl pouring out a string of reassurances, words of comfort and endearment. She was mothering her own mother.

We have all seen things like this. We have seen the filial become maternal and yet remain filial. The next morning that little girl was just as much a little girl as ever.

In the greatest affections all types of affection are present. Every husband and wife should be good friends, not merely good friends but also good friends. We need to recognize the different kinds of affection separately, but we need also to unite them. If you ever see a boy who is treating a girl unfairly, try to bring out the element of the brother in his feeling toward her; if you ever see a girl who is treating a boy unfairly; try to bring out the element of the sister in her feeling toward him. This is what is meant by love's "house of many mansions." Imagine a house, a great house, in which every room opens into every other room. It is in just that way that every human affection ought to open into every other

human affection. Imagine that the house has open windows throughout, so that each room is penetrated by the infinite outside, so that the winds of the infinite sweep through any and all of the rooms. That is the only way to think adequately of human friendship, human affection, in its relations to the divine,—each room, each part, open to all the rest, getting the strength and purification of the infinite spirit throughout.

Near the opening of Thomas Hardy's novel, "Jude the Obscure," is a description of a great university that I always like to remember. The novel is one of the great stories of college life, the greater and the more strange because it is the story of a boy who never succeeded in getting into a college and could only gaze longingly from without.

As the story opens Jude Fawley is coming out on the edge of the Downs, just above the Vale of the White Horse. He finds some men thatching the roof of the barn of a farm known as the Brown House. He asks the thatchers whether it is possible from there to see "Christminster"—Oxford, twenty miles away. They tell him that from the top of the ladder on a fair day the towers of the university town can be seen, and Jude, seeing those towers at a distance and for the first time, puts his thoughts into words:

"It is a city of light.

The tree of knowledge grows there.

It is a place that teachers of men spring from and go to.

It is what you might call a castle, manned by scholarship and religion.

It would just suit me."

"A castle, manned by scholarship and religion." That suggests the fourth thing by which men and women live—faith, faith in a person, faith in a cause.

Thinking, and play, and affection—these three without faith will not enable you fully to live. And by faith I do not mean acquiescence in some creed, however good,

for acquiscence is passive. Strange, how many people who would be scandalized at the thought of wearing second-hand clothes are quite content to take their religion second-hand, a hand-me-down. I mean a faith that is your own, first-hand. No man is truly living until he has found a cause for which he cares more than he cares for life itself, and for which he would willingly give his life. And a man may just as truly give his life for a cause over years and decades of devotion as in a moment on the battle-field.

Dr. John Melly, head of the British Red Cross unit in Abyssinia in 1935-36, was shot while rescuing persons in danger in the rioting just before the Italian entry into Addis Ababa. Here are some lines written to his memory; they show what I mean by faith.

"We stayed. Was there not busy reckoning to be done at home
Of fears, of costs—how many long, sharp nails go to a cross?
The ignorant dark people on their hills said "They will come.
Are they not strong who gave us their pledge " Your loss, our loss? "
He went—with those dark children. They came on, the white winged foes
In strength to work their will; with art to burn, to blind and rot.

He had no weapon; yet, clear-shining, merciful, arose
His purpose like a sword, defeating them—they know it not.
He went, young, smiling, urgent, with those happy few who said—
But not in words—of one flesh is mankind: who ran to give,
Unreckoning, the best they had, their lives (and he is dead).
We count our wealth of safety, yet—are we so rich who live?"

TUBE WELL IRRIGATION

(Continued from page 246)

to get the full benefit out of the tube-wells, a system of cart roads should be put in at an early date. If some Rural Development funds could be invested in roads, permanent results would accrue. Because of the positive and substantial achievements of the Irrigation Department in the west, I hope it will be encouraged to extend its beneficient activities to those tracts of the United Provinces which still lack such amenities.

WASTE PRODUCTS

FROM EDUCATIONAL ESTABLISHMENTS AND THEIR UTILIZATION FOR EDUCATIVE PURPOSES

K. A. PATWARDHAN,

Daly College, Indore.

Every residential educational institution has to dispose of horse or cattle-dung, litter, vegetable waste from gardens, scraped grass from the play grounds and road sides, dried leaves of trees and fresh ash from kitchens. For Nature Study and decoration, gardens have to be maintained which involves a considerable expense on the purchase of manures. At the Daly College about Rs. 200 to Rs. 250 were spent annually for this purpose. For a long time it was felt that it would be an ideal economy if the wastes could be so disposed as to meet the manure requirements of the Institution. Sir Albert Howard M.A., C.I.E., ex-Director of the Institute of Plant Industry, Indore, recommended his system of composting to Mr. Fanshawe, the late Principal of the Daly College, as a sure means of achieving this ideal.

In July 1931 a separate garden was established to enable the *kumars* to do practical work as part of their Nature Study work. It became rather difficult to meet increased demand for really good manure by means of Bazar purchase. This gave a fresh impetus to the previous idea and a sum of Rs. 100 was very kindly sanctioned as a special measure from the Science Grant, by the Principal, Mr. Salter, to give it a trial. The working of the process during the last four years has proved completoly satisfactory on all points. The trial demonstrated for the first time that horse-dung can be used for the making of compost by the Indore process, no other animals being kept at the College. It is considered that a review at this stage may be a useful guide to similar attempts elsewhere.

Site and Lay out:—A remote corner away from all habitations was chosen lest the place be unsitely but experience has shown that it can be kept very clean and tidy and the apprehension was totally unfounded. Starting from November 1931 with one pit 30′ × 14′ × 2½′ and three of 14′ × 10′ × 2½′ the present layout consists of two pits 30′ × 14′ × 2′ and two pits of 14′ × 10′ × 2′. These are enough to deal with all the wastes from an area of about 100 acres and the stable waste from about 10 horses.

Raw Material.—The relative proportions of available residues in the College compound are given below in table No. I.

TABLE No. 1

Type of Residues	Grass (Litter)	Garden Sweepings	Dry leaves	Horse dung	Kitchen ash
Percentage by volume ..	70	12	5	10	3

In addition 2 per cent. of black cotton soil and 1 per cent of fungus starter for 100 parts of above mixture are used.

OUTPUT—TABLE No. 2

Year	1932-1933	1933-1934	1934-1935
Number of cart loads	125	200	182
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Value in Rupees at Re. 1-8-0 per cart load	187 8 0	300 0 0	273 12 0

The above table will show that the efficiency of disposal of College waste has fairly increased.

Composition—Table No. 3

(a) On fresh sample.

Serial No.	Substances	1932	1933	1935	Remarks
1	Moisture ..	45·4	44·58	40·25	Steady decrease to normal
2	Fineness ..	62·5	75·30	84·6	Steady increase
3	Appearance and colour	Chocolate coarse stones in large quantity	Chocolate	Chocolate	

(b) On dry basis

Serial No.	Substances	1932	1933	1935	Remarks
1	Organic matter ..	22·1	28·06	42·15	
2	Ash ..	80·9	71·94	64·20	Steady decrease to normal.
3	Sand and silicates	..	49·18		
4	Nitrogen ..	0·96	1·22	1·42	Steady increase to a good stage.
5	(Lime) CaO ..	..	6·11	7·86	Steady increase to a right proportion.
6	P_2O_5 ..	..	0·37	1·73	
7	K_2O ..	..	0·99	1·45	
8	MgO ..	..	..	1·45	
9	Iron, Al, etc. ..	..	..	11·09	

Table No. 3 clearly shows that the quality of the compost has gradually been improving.

Water supply:—In the beginning water had to be purchased at the rate of 10 annas per cart-load of 240 gallons. This was carried to the pits from a distance of about 400 yards. In July 1933 when the College started teaching practical Agriculture to the *kumars* the College farm supplied bullocks for carting water in return for half time loan of the labourer working at the compost pits. The average quantity of water required at various stages was :—

TABLE NO. 4

Quantities in gallons

Pit.	At charge (6 days)	1st Turn	2nd Turn	3rd Turn	Later
Small ..	240	120	80	40	Given below
Big	720	360	240	120	Do.

N. B.—Water is sprinkled after charge on the surface every 2nd day in hot weather and every 3rd day in winter but it is preferable to sprinkle on every day till the second turn is given so that the moisture condtions are subsequently maintained. About 24 and 72 gallons are required during hot weather for the small and big pits respectively for each sprinkling and about 12 and 36 gallons in the cold weather.

Labour.—One man working 4 hours a day has been found to manage all the work, thus costing Rs. 60 per year at a rate of Rs. 10 per month for eight-hour-days. Thus an equal amount can be charged for carting water on the exchange system.

Profits.—The expenses and the receipts for the last three years are given below :—

TABLE NO. 5

Year	Expenditure	Receipts at Re. 1-8-0 a cart load.	Profits
	Rs.	Rs. a. p.	Rs. a. p.
1932-1933	100	187 8 0	87 8 0
1933-1934	150	300 0 0	150 0 0
1934-1935	140	273 12 0	133 12 0

Considering the higher quality of the manure the profits ought to be reckoned even higher.

Difficulties experienced in the early stages.

As is usual with the introduction of any new idea, this too had its own share. Some of them were :—

(1) Unwillingness of labour.

(2) Maintenance of the good will of the College *dafedar* and the syces in charge of the horses.

(3) Convincing the College doctor about the sanitary features of the process.

(4) Convincing the *malis* about the safety and the advantages of using the compost in gardens.

Actual experience has now convinced the *malis* about its value in the culture of flowers and vegetables. There was no difficulty in removing the prejudices of others with the help of a little tact.

The advantages of compost making as a routine in the upkeep of school establishments are thus clear. In addition, the successful use of horse dung in these trials, seems to open vast resources of humus supply, at the same time offering new sources of income to all keepers of stables. The Indian Year Book and Who's Who 1934-1935 Vol. XXI mention the number of horses and mules in the military stations as being about 30,000. The

disposal of the waste by this process from military stables in British India and Indian States is thus likely not only to give income in the ordinary course of keeping them clean but also make large quantities of badly needed rich manure available to the arable soils of India which are crying for humus. In fact Major Harris, O.B.E., the Secretary of the Coleyona Estate, Ltd., has reported that compost has been made from horse dung of 300 horses belonging to the stud farm since 1932.

"The process is now a regular part of the farm routine and has proved distinctly advantageous".

Summary.

Four years' experience at the Daly College has clearly proved the utility of the Indore process of composting vegetable wastes as a sanitary system for the disposal of rubbish and stable wastes obtainable from the school compounds. It leads to economy in garden up-keep. The Daly College trials have applied for the first time, since its inception by Sir Albert Howard, the Indore process for the utilization of horse dung. A high quality of manure has been supplied to gardens in large quantities. Details about the available raw materials, working, water supply, labour, costs and output are given.

Acknowledgements.

I am greatly indebted to Mr. M. G. Salter, Principal, Daly College, for the facilities and encouragement given and the keen interest taken in the work since its inception. I am also very grateful to Mr. F. K. Jackson, Director, Institute of Plant Industry, Indore, and Mr. Y. D. Wad of the Institute for giving me full facilities at the Institute for securing help and advice whenever needed.

(*Continued on page 268.*)

SANNHEMP AS A GREEN MANURE CROP IN THE UNITED PROVINCES

BY K. K. MISRA, B. Sc., AG.

It has long been known that green manuring enriches the land. In fact green manuring means sowing green crops for ploughing under to form manure when rotted. There are a number of crops which can be used but leguminous crops are particularly suitable; and agriculturist have made use of this knowledge in practice by growing leguminous crops for restoring the exhausted soils to their normal conditions or for reclaiming barren lands.

The most important green manuring crop grown in the United Provinces of Agra and Oudh is sannhemp. Although experiments were carried on and are still being carried on with *guara*, *dhanchia*, etc., in different parts of the province, yet these crops have not proved superior to sannhemp.

Sannhemp (*Sanai*) belongs to the family of *leguminosae*, and is known as *Crotalaria juncea*. It still grows wild in some parts of India and in some tropical countries and is generally recognised as a cover crop or a green manure crop.

Sannhemp is a stiff, shrubby annual, usually 4 to 7 feet high with rather narrow leaves 2 to 3 inches long. When in flower it is quite decorative bearing fairly farge bright yellow flowers, in upright sprays of about one foot in length. These are succeeded by tough-skinned pods each containing numerous small seeds. In the corolla, the upper and largest petal stands erect, forming the standard, the two lateral petals are wings while the two lower petals adhere along their adjacent edges to form the keel. In these flowers there are usually ten stamens which commonly occur in two groups or brotherhoods (diadelphous), nine in one group with their

filaments united into a tube, cleft on the upper side, the other standing alone on the cleft.

Pollination is generally accomplished in this family by means of insects which visit the flowers for the nectar secreted by glands.

Like so many other leguminous plants sannhemp is able to utilise directly the nitrogen of the atmosphere, and being also a plant of very rapid growth, capable, when sown thickly, of smothering many tropical weeds, it is of value as cover crop and as a soil renovator. For these reasons sannhemp is often grown in India (mostly in the United Provinces) as a rotation crop immediately before such crops as sugar cane, tobacco, potato, etc , and also on land newly brought under cultivation as it will thrive even though the tilth is not good. When sown in fields reclaimed from *kans* grass (*Saccharum spontaneum*), a persistent weed which has overcome thousands of acres in the United Provinces, it grows luxuriantly and helps to smother any *kans* plants left. It should be one of the best crops for cleaning and preparing land for permanent crops at least in these provinces. For green manuring the whole plant is ploughed in as a manure and is not utilised for the preparation of fibre. Comparatively recent investigations indicate that it may well be practicable to attain both objects at the same time.

As a green manure plant it has proved to be one of the very best. It is hardy and grows rapidly and does not require any very large amount of moisture and gives a good yield of green stuff to plough in which, if taken at at the right time, will rot quickly. Where irrigation is available sannhemp, for green manuring, should be sown about the beginning of June and should be ploughed by the middle of August, or at the latest by the first week of September by which time it gives about 10 to 12 tons of green dressing per acre. Where irrigation is not available the crop can be sown on the first light showers of rain. It will then grow rapidly as soon as monsoon proper commences. It can be sown successfully in these

provinces up to the first week of July. In using sannhemp for green manuring, care is necessary that it is not allowed to grow too big nor allowed to stand in the field too long. It must be ploughed in before the stems get woody, otherwise it will not rot properly. In many text books the statement will be found that green manuring crops should be ploughed in when flowering. This is not correct for sannhemp, as by that time it is too fibrous to rot properly. It is much better to plough in at the proper time than to wait too long and run the risk of imperfect rotting.

The best way for ploughing in sannhemp is to lay it down with the wooden beam (*patela*, *henga*) and then turn it under with an iron plough. Care should be taken that the plough travels in the same direction as the *patela* otherwise the stalks will not be properly covered. The *deshi* (local) plough does not cover it sufficiently for green manuring and this is one reason why we do not find an extensive use of green manuring crops in these provinces, in spite of the fact that it is very economical. So, for efficient use as green manure, the introduction of some kind of soil-turning plough is very essential. On small fields the green crop can be cut by hand before ploughing it under, thus ensuring even distribution.

After ploughing in sannhemp the field can be left for three or four weeks, but if there is marked break in the rains it is desirable to cultivate the field with a harrow or if this is not possible, to give a very light ploughing with a country plough. Towards the end of the monsoon one deep ploughing with an iron plough is necessary to get the best results; the plough being set at such a depth as to thoroughly mix the manure in the soil but not to bring it to the surface.

The practice in the villages of the United Provinces is similar except that most of them have not got soil-turning ploughs and harrows; instead of which they use their only implement the *deshi* plough. For rotting, they in some cases flood the field. Villagers mostly

green manure a field in which they are expecting to plant some crop like sugar cane or wheat.

Green manuring does well on all light soils. It will be a failure on badly drained soils, if ploughed in too late or if insufficient rainfall occurs after it is ploughed in. In canal irrigated districts in years when September rains fail it is advisable to flood the land once to ensure the rotting of sannhemp.

The above description of green manuring is based on the assumption that it will be followed by a rabi crop such as wheat, etc. Green manuring for ordinary *kharif* (monsoon) crops is usually out of the question as the green crop would not rot properly. Green manuring for rice is sometimes possible if irrigation water is available to enable the green manuring crop to be sown in April and ploughed in towards the end of May. Good results have been obtained at the Attara farm (Banda district) by green manuring for sugar cane. In this case the green manure crop can be sown in June or July and should be ploughed in by the middle of August so as to ensure proper decomposition. The land is then cultivated two or three times during the cold weather and the sugar cane planted in the following February.

The disadvantage of this is that it occupies the land for the whole of the *kharif* and the portion of the *rabi* season preceding the sugar cane crop. Green manuring alone is not sufficient for sugar cane; it must be supplemented with other manures.

The Agricultural Adviser to the Government of India (1926-27) states that the sannhemp plant plays an important part in the economics of Indian agriculture as it is also largely used as a green manure. Extension of its cultivation is therefore important, supplying as it does both a cheap but valuable organic manure and a marketable fibre. It is thus a dual purpose crop. The hemp fibre exported in the year 1926-27 under review fetched Rs. 83 lakhs. At present sannhemp is grown either for conversion into manure or for fibre. Experi-

ments at Pusa, however, have conclusively shown that the same crop can be used economically for both, the tops as a manure and the stems for fibre. It is common practice in the villages of these provinces that tops are fed to cattle and stems are used for fibre.

The first and important factor governing the cultivation of sannhemp is the soil. In other words, sannhemp only thrives on permeable, well aerated soils; water-logging is harmful for fibre purposes and still more so for seed production. These requirements have helped to drive the cultivation away from the deltas, towards the higher and better drained parts of the country. In this higher and better drained parts it grows practically on almost all types of soils.

Ordinarily the field is prepared by ploughing two or three times. The seed is broadcasted and harrowed, sometimes followed by planking. This is done when the crop is planted after the first shower. In case the crop is planted early in May or June, the field is first irrigated, ploughed twice at least, and then the seed is broadcasted followed by harrowing.

The amount of seed required per acre varies greatly with the method of sowing. For broadcasting, sometimes 40 seers of seed per acre is used. In any case it is important that plants be spaced closely in order to ensure good thick smother or cover crop with plenty of vegetable matter. A three months' crop should yield 10 to 12 tons of green dressing per acre.

The great advantage of planting sannhemp for green manuring in these provinces is that it is in a way a catch crop. So there is not much loss. Beside this it occupies land in the rainy season when if the soil is exposed to rain, great loss is done by leaching and many soluble plant-foods are carried out. Beside the saving of plant nutrients from leaching it also fixes atmospheric nitrogen in the soil.

The improvement of the physical conditions of the soil is usually brought about by green manuring. Porosity,

the water retaining-power, the absorptive power and other physical conditions are considerably improved. We have to remember that green manuring under the most favourable conditions can only improve the physical conditions of the soil and enrich it in organic matter and nitrogen, but cannot effect any increase in its inorganic constituents. The stores of phosphates, potash and lime in the soil are not augmented though these constituents are properly rendered more available.

In cases of soils extremely poor in organic matter, the growing of a crop and then ploughing it in, specially of such leguminous crops as sannhemp, results in rapidly enriching and improving the soil.

As to how legumes fix the atmospheric nitrogen in the soil was explained in 1886 by Hellriegel who published an account of the bacteria which he found in the root nodules possessed by clover and other leguminous plants. Wilfarth also showed that living in these nodules were bacteria (*bacillus radicicola*) which have the power of bringing abont the assimilation of free nitrogen by parent plants. Further study has shown that various legumes have different bacteria, and that the assimilation of free nitrogen by plants depends upon the presence of these in the soil.

The fact that the yield and quality of crop varies with the locality suggests that the crop should receive intensive study with the object of producing higher yielding varieties. One great obstacle, however, stands in the way. The flowers of this plant as described previously are self-sterile, and only set seed after being visited by insects. Cross fertilisation is the rule, and the crop is a complex mixture of forms which do not breed true. The labour involved in isolating an improved type and in the organisation of the seed supply would be quite beyond the means of any man interested and should therefore be taken up by an organisation or agricultural department itself.

The subject will be incomplete without a description of diseases and pests. The plant is apparently usually

free from serious diseases and pest. But a few fungoid diseases, *e. g.* wilt and anthracnose, have been noticed in various places, although in general the plant is free from serious trouble of this nature.

Rust (*Uromyces decoratus* Syd) does a good deal of damage in the other parts of India, as in the Godavari region, and has also been found at Dehra Dun and Dacca. It is known in Ceylon on allied plants. All parts of the plant above ground are liable to attack, the stem being often very severely affected, and the leaves, petioles and fruit also involved. As with most rusts the treatment is difficult. It is not known whether any variety is resistant to the disease or not.

As regaıds pests, the caterpillars of some moths may at times do a good deal of harm by eating the foliage. In some places the caterpillar of a moth (*Utethesia ornatrix*) attacks the young seed in the pod, but does not harm to the foliage. In dry season this difficulty is not experienced.

WASTE PRODUCTS

(Continued from page 261)

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SOIL EROSION AND ITS CONTROL

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The extent of damage caused by soil erosion was not realized until very recently, when soil science and its associate subjects were developed. Now that we have statistics on the subject, we know that millions of acres of land all over the world have become, and are becoming unfit for cultivation through erosion. In America alone, according to the latest statistics, 50 million acres of land have been made unfit for cultivation, and about 120 million have been damaged. If we were to calculate the effect of loss of such vast lands on the production of crops, we would find what an enormous difference it makes.

In places where the soil is shallow it is a more serious matter when any amount of it is lost. This kind of land, if eroded to a great extent, becomes a permanent loss. As the formation of soil from rocky material is very slow, it will take a great many years to replace it. In other places where the soil is quite deep, the havoc played by erosion can be remedied by reclamation. But if the time, labour and capital necessary for the reclamation of a land, which took probably a year or two to erode to that extent, be taken into account, it will be easy to realize the immediate need for the prevention of erosion.

Reclamation is a pressing need. There are eroded lands all over this country which on reclamation would bear valuable crops. It will pay to look for such lands. Because it is so much easier and cheaper to prevent erosion than to remedy it, the immediate task is the problem of preventing erosion.

But before proceeding to the control of erosion, the factors and circumstanctes which induce it must be known.

There are two important causes of erosion and they are:

I. *Rain and Run-off*: This is by far the most important source of erosion, which can be dealt under three headings:

1. Rate of rainfall: As the rainfall increases at any one time, the percentage of run-off, and the rate and amount of erosion all increase. If the velocity of a stream of water be doubled, then :—

(*a*) It will cause four times as much erosion as it did normally ;

(*b*) It will carry away 32 times as much material as it did normally ; and

(*c*) It will carry 64 times as large particles as it did normally.

2. Distribution of rainfall in the year: A uniform distribution of rain throughout the year generally reduces heavy showers which consequently causes less run-off. Erosion is thus reduced.

3. Amount of annual rainfall: Erosion also depends upon the total amount of rainfall during the year. Places which receive more rainfall have more erosion.

There are three other factors which greatly influence the amount of erosion caused by run-off:

(1) The slope of the land: Erosion increases with the increase in the slope of the land.

(2) Nature of the soil: As ability of soil to absorb water decreases, erosion increases.

(3) Poor cultural methods of handling soil:

(*i*) Shallow ploughing is one of them, as most of the water which falls on the soil is not absorbed.

(*ii*) When a sloping land is ploughed down the direction of the slope, the run-off water

comes down the furrows more rapidly than if the furrows were made across the slope. Thus it causes more erosion.

(*iii*) There is less erosion where the soil is covered with vegetation, and the better it covers the soil the less the erosion.

Erosion is prevalent in two forms: 1. Gully erosion and 2. Sheet erosion.

1. Gully erosion: This kind of erosion cuts channels in the soil and gradually deepens and widens them. This is caused by allowing the run-off water to accumulate in any one particular slope. If this is not checked with every rain, the slope and the erosion will have accumulative increase. These channels commonly occur in a very irregular manner, and in the midst of tillable land. So in addition to being a loss in itself, it greatly increases the cost of cultivation.

Though to all appearance this kind of erosion seems to be a great evil, still in some parts of the world, nature has turned it to a better account. The Nile river in Egypt, the Ganges and the great rivers of China, bring down from their sources in the highlands, enormous quantities of silt, and deposit it on their lower courses providing sustenance for millions of people.

2. Sheet Erosion: The damage done by sheet erosion is not apparent; but observation shows that this kind of erosion is more serious than gully erosion. This kind of erosion requires immediate attention because it washes away the topmost layer of the soil, which is most rich in organic content and other nutritive elements whose formation takes a long time.

By the removal of organic matter, the crumb structure of the soil is destroyed, and the finer particles of the soil are carried away leaving a soil of coarse structure.

Ordinarily, farmers do not make any effort to increase the organic matter of their soil. Year after year they take crops and in the way of organic matter, leave only

the stubbles and roots in the soil, which can hardly compensate for the loss. When year after year sheet erosion carries away a part of the top soil, no wonder their crops do not do well.

II. *Wind Erosion* : Wind erosion is mostly confined to the great plains of America. The usual method of cultivation in those parts is to keep the ground fallow during the dry season or summer, after the crops are harvested. The result has been that the strong winds which are prevalent there, sweep away the top soil and form huge dust clouds which are carried hundreds of miles and deposited in large cities causing great inconvenience to the people. Before these plains or prairies come under cultivation, they were covered with grass, and so wind erosion was not known.

This erosion has raised a very grave problem in America. At the rate at which the top soil is lost, erosion will make the soil unfit for cultivation in a comparatively short time ; the finer soil particles are blown away, while the coarser particles remain.

Excavations in the Gobi desert show, that once a great civilization flourished there. It is alleged that the whole of that region was covered with forests. But as more and more land was brought under cultivation by cutting down trees, the rainfall diminished. When the people left the place and migrated to other parts of the country, their abandoned land was left to the mercy of the winds. In the course of hundreds of years it was reduced to a vast desert. There are many towns in China also, which suffer from great dust and sand storms.

The Prevention of Soil Erosion : The great problem of erosion control is to bring rain and run-off under control. Every individual farmer should take up the problem seriously, because the country is made up of individual farms, and therefore has direct influence upon the economics of the country as a whole.

The countries suffering from wind erosion have a greater problem. The individual farmer can do something

towards its prevention, but on the whole goverments are better able to take up this responsibility and can manage the work more successfully.

In order to control erosion from rain and run-off, several methods may be adopted.

1. By increasing the water-absorbing capacity of the soil.

(i) Supplying the soil with plenty of organic manure, which can be either in the form of farm-yard manure or green manure.

(ii) Pulverising the soil by ploughing. But one thing should be kept in mind. If heavy showers are expected, it would not be wise to have shallow ploughing; because the loose layer of soil will be carried away before the rain can percolate through the compact sub-soil. Under such circumstances deep ploughing is desirable.

2. Strip cropping: When a certain crop has no good properties of preventing erosion, sometimes another crop which is closer growing can be sown at intervals, in strips of 10 feet in width and across the slope with the main crops.

If a farmer is in the practice of sowing a part of his land one year and the next part the following year, keeping his previous one fallow; it would be much better if he could divide the whole land into regular strips running across the general slope of the land and sow alternate strips one year and the next alternate strips the next year. This will prevent a great deal of erosion.

3. By growing certain crops especially adapted for preventing erosion. There are some plants, for example, sannhemp, which are especially grown for:—

(i) Checking the flow of the water.

(ii) Protecting the soil from the rain directly beating upon it because of their dense foliage.

(iii) Loosening the soil to a degree by growth of roots and letting the water percolate more easily.

Such plants are known as cover-crops, and their main object is to protect the soil and not to yield a harvest. In India, however, most of the farmers either cannot afford or do not want to take a season for the growing of cover-crops, from which they could not expect any yield.

The cover-crop is almost always a legume which has the unique property of extracting nitrogen from the air through the agency of nitrifying bacteria, and thus supplying nitrogen to the soil, as well as humus.

The problem of turning the cover-crop under the soil at the right time is very important. It should be turned under before the rainy season is over, so that it may have ample time to decay. The time for sowing cover-crop will therefore vary with different cover-crops, because their rate of growth will vary.

Sannhemp, which is commonly grown as a cover-crop if sown at the beginning of the rains, attains a height of about three feet within a month. It is then quite ready to be turned under, and will decompose without any difficulty before the winter crop is sown. Because the rainy season extends more than three and at least two months, it therefore provides enough moisture for the decomposition of the cover-crop.

To get an idea as to how far it is beneficial to turn under the cover-crop at the proper time, two fields can be compared. In one the cover-crop is turned under the soil late, and in the other at the proper time.

In the first case:—

1. The cover-crop does not find time to decompose completely before the sowing of the winter-crop, because of the lack of sufficient moisture.

2. For further decomposition it will share the soil moisture with the growing crop, and will therefore reduce the yield.

3. It will keep the 6 or 7 inches of the top soil loose and will interfere with the sowing operations and the germination of the seeds.

4. Sir Howard, formerly Director of the Institute of Plant Industry at Indore, asserts that the process of decomposition going on while the plant is growing, injures the plants and reduces the yield considerably. Moreover, experience has also shown that this kind of cover-cropping has given the worst results.

In the latter case:—

1. The cover-crop has the time as well as sufficient moisture to decompose before the next crop is sown.

2. There is no loss of soil moisture for the succeeding crop.

3. After the cover-crop is turned under, the top layer of the field is left loose and rough. Therefore it is more ready to absorb the maximum amount of water. This factor also applies to the first case, but the rains are not as frequent at that time to be utilized.

4. By the sowing of the next crop, the cover-crop would have completely decomposed and formed into humus. Therefore, it would not interfere with the sowing operations or the germination of the seed.

This method has been found to be the most satisfactory one.

The control of erosion generally cannot be complete without the aid of some mechanical means. This often will require engineering skill and knowledge, and therefore in such cases the help of engineers should be taken.

The building of bunds and spillways help to a great extent to save land from erosion. Sometimes small bunds erected in time may save lands from being ruined.

Contour ploughing is applicable on sloping lands. In this method of ploughing, all the land on the same level is ploughed at one time and in a direction across the slope.

(*Continued on page 281*)

PUMPING FARM LAND FROM THE SEA

By Peter Keyser, B. A., B. S. A.

"The 'little hero of Haarlem' is doing a thoroughly scientific job of reclamation; moreover, he believes that it will pay even at present prices for agricultural products."

The first, though smallest, of the four polders to be reclaimed from the sea by the diking and draining of the Zuyder Zee, Holland, has at last been completly drained. The Dutch may be pardoned if, in this period of world-wide economic depression, they pause to take stock of the future and at the same time take justifiable pride in the accomplishments of the past.

It is no secret that the initial costs have exceeded considerably the original estimates. There has been a considerable increase in dredging costs since 1924, when estimates for the scheme were figured, and, in the construction of the dams in the open sea, forces that could not be foreseen have been encountered.

As estimated in 1924, in pounds sterling, the costs were as follows:

Work To Be Executed	Cost
A—Reclamations:	£
N. W. polder	3,100,000
S. W. polder	8,400,000
S. E. polder	11,900,000
N. E. polder	7,000,000
Total cost until the land reaches normal value ..	30,400,000
Less output until the land reaches normal value ..	7,900,000
Total .. .	22,500,000
B—Enclosing dam	7,500,000
Total	30,000,000
Interest (5 per cent.) until land is sold ..	15,300,000
Total	45,300,000

Profits were estimated to be as follows:

	£
A—Reclamations:	
N. W. polder	3,600,000
S. W. polder	10,000,000
S. E. polder	18,300,000
N. E. polder	10,100,000
B—Enclosing dam	10,000,000
Total	52,000,000

The cost of supplying requirements for national defence and fisheries has not been figured in the cost of the reclamation. It has since been estimated that the cost of the main enclosing dam—estimated originally to cost £7,500,000—will reach £10,000,000. This estimate is arrived at by subtracting from the revised 1928 figures of £10,700,000 the sum of £700,000, arrived at by deducting 8½ per cent. of the cost of the 1929 outlay, as prices in 1929 had declined the percentage from the 1928 prices.

An undertaking involving the expenditure of more than $200,000,000 and which may cost $250,000,000 is significant, even in this day of huge projects. Just what are the Dutch planning to accomplish by it? Briefly, they hope to add seven per cent. to the total and 10 per cent. to the arable area of the Netherlands—a total of 550, 000 acres. These figures are arrived at as follows:—

N. W. polder	50,000 acres
N. E. polder	135,000 acres
S. E. polder	230,000 acres
S. W. polder	135,000 acres

A whole new province, as large as the present province of Groningen, will be added to Dutch territory. Holland is essentially an agricultural nation, and the addition of this land will go far to make the Netherlands self-sustaining. As remarkable as her developments in the East Indies have been, they can be matched to some extent, at least, by reclamation projects at home. Actually since 1846, there has been reclaimed from the sea by embanking about 250,000 acres, while former waste lands,

of which there is still a goodly amount, have been put to the plow to the extent of 800,000 acres during the same period. Therefore, during the past century more than 1,000,000 acres of arable land has been added to the Netherlands.

The population has been increasing and consequently more land has been diverted to such non-agricultural purposes as the extension of towns, construction of roads, canals and harbours. Dutch statisticians have figured that in the ten-year period from 1912 to 1921 an average of 6,000 vital acres have been withdrawn from cultivation annually. The Dutch regard these losses and the increasing population as indications of a forth-coming shortage of arable lands. The increase in the rural population of the country has accentuated this shortage. Except for temporary reversals land prices have risen continuously during the past several decades. Land sales attract large numbers and the bidding is spiritod. Young men, discouraged with their prospects on the farm, have deserted the agricultural areas for the cities. And it is even feared that the "unnatural" extension of horticulture and floriculture will result in a shortage of land for essential crops.

These and other considerations are the reasons which led the reclamationists to give up their plan of enclosing the Zuyder Zee before undertaking any reclamation work. The reclamation of the Wieringermeer polder—the northwest one—was therefore undertaken contemporaneously with the construction of the main eighteen-mile dike. This polder has already been completely drained and sections of it have already been put under cultivation.

Modern agricultural science has prepared the way for this. In 1927 an experimental polder of 100 acres was created near Andijk, and extensive research has been conducted with regard to removing the sea salt from the soil and to preparing the soil for agriculture. The land being reclaimed has been under the sea for centuries and consequently has a considerable degree of

salinity. Tests have indicated that the north-west polder, already reclaimed, has an average salinity of 2 per cent. as contrasted with $1\frac{1}{2}$, $\frac{3}{4}$, and $\frac{1}{2}$ per cent. in the south-west, south-east and north-east polders, respectively. These percentages show the influences of fresh water carried into the Zuyder Zee from the Rhine and other rivers, and the larger percentage of the Wieringermeer polder results from the fact that it is in closest proximity to the North Sea.

Research on the experimental polder has taken three forms. There has been a physico-chemical soil research, to collect data with respect to the leaching out of the soil, the transmutation of natron-clay into lime clay and the properties important to soil-structure. Then there has been micro-biological research to obtain insight into the gradual transition of the sea bottom to cultivated soil in so far as lower organisms have a part in the change. A third stage has been the laying out of experimental plots to collect evidence about the possibilities of cultivation during the different stages of evolution of the young soils.

The first year the polder was cultivated (1928) the mixtures of grasses and clovers gave a good crop with a large output, while the clovers planted by themselves also gave a good yield. In 1929 the whole polder was cultivated. Plots were sown with oats, peas, beets and mustard to test the need of nitrogen, phosphorus and potassium in the new soil. Other experiments were started with trees and horticultural crops.

The new polder has itself been divided into four sections, corresponding in general to the height of the drained land. Each section has its own water-level, which has been fixed at four feet and eight inches below the surface of the lowest land in the section. The provisional water levels of the canals and drainage ditches have been fixed at from fifteen feet, two inches in one, to twenty-two feet in the lowest, below normal Amsterdam level. Public buildings will be constructed on a mound

in the approximate centre of the polder, and from that mound there will extend, principally along canals, roads to present important cities and villages surrounding it. This mound is 110 yards wide by 220 yards long, and has been built at a height of six feet and six inches above normal Amsterdam level. It would thus serve as a haven of refuge in case the polder should conceivably be inundated by the sea.

In order to obtain proper drainage of the newly formed land, an extensive system of small canals and main drains has been dredged. It is estimated that 12,000,000 cubic yards have been dredged for the canals and about 8,000,000 cubic yards for the main drains. A variation in the height of the water by ten inches would be disastrous to the crops in the polders, and consequently the two pumping station—one at Medemblik and the other near Den Oever—have been constructed with capacities far beyond those ever expected to be required.

The entire undertaking reveals repeatedly the extreme caution—or precaution—the Dutch have exercised in carrying out plans. For example, the two pumping stations now at work maintaining the proper level in the canals of the Wieringermeer polder operate with different fuels. "Lely" station at Medemblik, named after the former Minister of Public Affairs, who is largely responsible for the undertaking of the project, operates electrically, while the "Leemans" station at Den Oever operates with oil-burning Diesel engines. The plant which operates the more economically can be operated at full force, with the other plant as semi-auxiliary to it. The two pumping stations can remove 380,000 gallons of water a minute, or 5,500,000 a day, under normal conditions.

The task of building the main eighteen-mile dike from the Isle of Wieringen to the Friesland coast is completed. Access to the Zuyder Zee, or from it to the North Sea has been cut off except through the already completed ship lock, forty-six feet wide and 465 feet long,

at Den Oever. Tides will ebb and flow across the sill dam until the time is opportune for the Zuyder Zee—or the Yessel lake, as it will henceforth be known—to become a land-locked body of water.

The base of this gigantic dike is 300 feet wide, and the dike will rise to a height of twenty-five feet above what is known as Amsterdam sea level. This is about ten feet above high tide and will prevent, it is believed, the waves of even the heaviest North Sea storms from overtopping it. Across the dike there will extend a line of steel for the railway and a line of concrete for the roadway which will bring the Province of Friesland in closer contact with Amsterdam and South Holland.

SOIL EROSION AND ITS CONTROL

(Continued from page 275)

For reclamation of land, dams and spillways are constructed which serve a double purpose for reclamation as well as preventing erosion. This is the work of an engineer, and at every time, he should be consulted.

Terracing is another method employed on very sloping land. Mangum Terracing is a special method being employed in America which makes operations very convenient. It is a modification of the form of terracing one sees in the hilly parts of India and elsewhere.

A method to prevent wind erosion has not been found yet ; it is still in the experimental stage. In America there was a proposal to construct forest belts at intervals in the wind-eroded regions to act as wind breaks. To what degree this will be successful only experiments can reveal.

THE SANGLI MOVABLE SCHOOL *

A TRAVELLING SCHOOL IN WESTERN INDIA

Dr. Booker T. Washington, that great soul of wide vision and deep insight into the problems of practical and constructive education for the Negroes of the U. S. A., not only built up a large and most useful educational institution, The Tuskegee Industrial & Agricultural Institute, but also took it upon himself to deliver education to those in distant hamlets and villages who were not able to oome to Tuskegee for it.

Quoting from the July, 1927, number of "Better Crops with Plant Food", on the subject "Wheeled Schools deliver Education", it is stated, "The Negro farmer as a rule is diffident about attending the regular agricultural instruction given at central points in the various communities. And the more ignorant he is the more difficult it is to get him out. To Booker T. Washington and his faith in the principle of learning by doing, the new scheme of things owes its beginning and its promise of great achievement. He knew the Negro farmer well enough to know that there was no hope for advancement unless modern training could be carried to his very doorstep."

And so, "1906 Washington built the Jesup Agricultural Wagon". "It was fitted with farm implements, dairy apparatus, garden tools and crates containing specimens of improved types of crops and livestock.. With the wagon went an agricultural extension demonstrator. Nothing more ambitious than the county surrounding the Tuskegee Institute was attempted. But it was a success, so much so that later when automobiles came in, a truck known as the Knapp Agricultural Truck was substituted".

" This truck has carried better farming and homemaking into every county in the State where there are

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* A reprint from "News and Views on Rural Reconstruction," (July 1937)

Negro extension agents and is still in use. But the scheme was to be pushed further. In 1923, by contribution from some 30,000 Negro farmers and their friends, a large truck especially designed for the work was built. It is known as 'The Booker T. Washington Agricultural School on Wheels.' This truck carries a complete stock of farms implements and home conveniences such as the average farmer would be able to buy or construct and operate. With it goes a man to demonstrate the use of the equipment and to teach improved methods of farming; a woman to show how to make and use the home conveniences, and to cook, can (preserve), care for poultry, and couduct the home on a more healthfuland economic basis; and a rural nurse who gives demonstrations in care of the sick and simple practices of home sanitation and hygiene"......

Having seen the Booker T. Washington Agricultural School on Wheels actually at work in a small hamlet and having noted the enthusiasm with which its many-sided programme was received and made use of by the men, women and children of that neighbourhood, the writer was inspired to try to secure a similar 'travelling school' for the institution in India with which he is connected, the Sangli Industrial, and Agricultural School. Any one who has taken the trouble to investigate will agree that there are a good many problems in common for the uplift of the backward Negro and the illiterate villagers of India. The latter are hard to reach and it just as necessary to 'deliver education' to them as it is to deliver it to the Negroes. More especially is this true of the women of the village.

The Sangli Movable School came into being in the early part of the year 1931. It is not an exact duplicate of the Booker T. Washington Agricultural school on Wheels but the main idea is there. It has been fitted up so as to be of special use in the way of practical teaching and demonstration to the people of village India. Through the use of numerous charts, posters and pictures on all kinds of subjects pertaining to village life; also small and improv-

ed livestock such as fowls and good milk-goats; simple and better implements such as fodder-cutter, light iron plough and cultivator for the lighter soil (unfortunately the heavier implements cannot be carried); samples of seeds of improved and tested varieties of field and garden crops and specimens of potatoes and sweet potatoes, ground-nuts, wool and cotton, etc; this school aims to put on an exhibition such as will be of use to each village visited.

It also carries an earth auger for the making of bore-hole latrines; tools for digging model manure pits, a trunk full of books on Agricultural and similar subjects in Marathi and English which serves as a Reference Library, and there are similar simple and useful books on many subjects for sale. There is a medicine chest with much-needed yet simple remedies, a gramophone to furnish music and amusement, and a magic lantern and cinema projector with small special electric generating unit, not to mention electric-light bulbs which illuminate the scene at night like fairy-land. What crowds always attend and what an opportunity to teach through eye-gate and ear-gate at the close of the day, when the people, big and little, are free to sit and learn!

The displays are set up in sections, as it were. Here is a section dealing with Sanitation and Preventive Medicine; another section has to do with Agriculture and Field, Fruit and Garden Crops; a third has to do with Child Welfare; and a fourth with Cottage Industries such as Bee Keeping, Soap Making, etc. etc The Poultry and Livestock Sections are always popular. There are generally three members of the crew, *viz*, the manager and general utility man and he is a very capable and talented individual; an agriculturist who knows that end but also makes himself generally useful; and a helper who has no end of things to see to. These three are kept busy from early morning until after mid-night, and it is truly a strenuous life they live. There are special days or times for the women and school children, and if Boy scouts are to

be found in a village, you may be sure they are put to a good use in a clean-up campaign, or something of that sort.

The school will stop from 30 to-45 days in any given place, this depending on the size of the place and interest shown, etc. An average stop would be about 30 days. On one night of the period it is usually the practice to put on a drama, say the last night of the visit, scool boys and masters having been coopted to make this possible. The booklet, "Little plays", by Emily Gilchriest Hatch, is most useful for this purpose. It is always the aim to leave something permanent in the village as a result of this visit, say some model manure pits or bore-hole latrines, or the organization of a poultry club, or a few seeds of some improved crops, or the orgnization of a village reading-room, etc. If ever again the school visits that locality, follow-up work must be carried on of course, and this is always also done through the contacts made.

During the monsoon season the school is used at headquarters for bazaar demonstrations, etc, and then too, a general over-hauling of every thing connected with it is always required. During the rest of the year it is on 'the move' most of the time. It visits a good many agricultural exhibitions, helps with Baby & Health Week celebrations, and is much in demand for such affairs. However it is at its best in a central village far off the beaten path, where the general populace is so handicapped by ignorance, poverty, disease and debt. In such a place the Sangli Movable School delights to give its message of hope, Good Cheer, Light and Love.

J. L. G.

NOTICE

The International Institute of Agriculture at Rome, has recently published in the "International Review of Agriculture", a study describing the results obtained in respect of ploughing technique.

Book Reviews and Abstracts

Agricultural Prices in the United Provinces. BY RAJ BAHADUR GUPTA. (*Government Press, Allahabad, 1937*) pp. 101, 5 diagrams, Price, Rs. 2.

This monograph is an attempt to trace the course of agricultural prices in the United Provinces from 1861 until April 1937.

The book contains the retail prices of some of the most important crops, as well as the wholesale prices of such crops as rice, wheat, barley, maize, gram, *arhar*, linseed, *til*, sugar, cotton, and tobacco. Index numbers of the retail prices as well as of the wholesale prices are given. The book also contains a statement of the rents, revenue, area, population, wages and rainfall in the province.

At the end the author has attached five diagrams showing in graphical forms (1) the curves of retail prices, (2) the curves of wholesale prices, (3) the curves of prices, rainfall and cultivated area in U.P., (4) the curves of agricultural population, wages, prices, rents, and land revenue, and (5) the decennial average curves of wholesale prices, rents and revenue.

All these data should prove very helpful to students of agricultural economics, and we therefore recommend the book to all those who are interested in the subject.

Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June 1936. (*Government Press, Allahabad, 1937*) pp. 64. Price, annas five.

This little book besides giving the public some information about the working of the department in such matters as the distribution of improved seeds, implements and manure, reports also on the results arrived at or indicated from the experiments conducted in the experimental farms throughout the province.

Manurial experiments seem to indicate that, on a soil of normal fertility, the yield of sugar-cane is practically the same whether the source of nitrogen added is farm-yard manure; oilseed cakes, such as castor, rape or neem; or chemical fertilizers in the form of ammonium sulphate; and that sugar-cane in general cannot profitably utilize more than 1 lbs. of added nitrogen.

Irrigation experiments with Co. 313 (sugarcane) seem to indicate that five light irrigations of 80,000 gallons to the acre is better than a smaller number of heavier waterings of 1,20,000 gallons per acre per irrigation.

Experiments with the interculture of sugarcane also indicate that one deep hoeing with *khasi* is better than three with *khurpi* or three shallow hoeing with *khasi*; while two deep hoeings with *khasi* after each irrigation gave the best results.

Varietal trials with new selections of sugarcanes has resulted in the selection of three new canes, Co. 378, an early variety, and Co. 393 and Co. 411. Physiological investigations have also shown that Co. 370 is the earliest of all varieties with Co. 385 ranking next.

Experiments with rice at the Nagina Research Station indicate that no significant increase in yield has resulted with the application of manures and that there was no significant difference in yields of rice due to different manures. The rice crop in these experiments was grown after gram. Irrigation experiments showed that an application of 40" of irrigation water was as good as applications of 60" and 80". Varying seed rates of from 5 to 15 seers per acre for transplanted rice did not show any significant difference. Similarly seed rates of 20, 25, 3 and 35 seers per acre by broadcasting with T. 12, an early variety, also failed to produce any significant difference.

Experiments with oilseeds show that linseed No. 1193 is generally superior to other strains such as 1150, 1195 and 1206 which are also considered to be rust-resistant and high yielding with a fairly high oil content. Of the

various mustards included in the experiments it was reported that *rai* type 11 has given the highest yield followed by type 9. Of the safflowers tried at Cawnpore, type 56 has been found to be superior to others. Of the groundnuts, strains 18, 23 and 24 have been reported to be superior to Akola 10, the standard variety of the province. Of the sesamums, types 1, 6, and 8 which are white-seeded and early maturing have been recommended.

The department has also evolved the following maize varieties: types 10, 13 and 41 ; the following *juar* strains : 5 tall, 8-B and 30-C; the following *bajra* types : 11, 12 and 16.

Of the many strains of *arhar* which have been collected from different parts of India, the department has selected four strains: 4, 17, 23 and 51. Of these, type 4 is an early strain and is ready for harvest in the first week of January, and type 23 is a very heavy yielder but is not ready for harvest until the end of March.

The sunnhemp strain, C-12, the wheat type C-13, and the barley type 251, are still considered the standard varieties of these crops for the province.

Varietal trials with potato seem to indicate that Phulwa and Katie Glover are the most promising. The former is a very high yielder, but the tubers of the latter are better in quality and therefore bring a better price in the market.

The Classification of the Cottons of Asia and Africa.

J. B. Hutchinson and R. L. M. Ghose. (*Indian Journal of Agricultural Science*, Volume VII, pp. 233-257.)

This new classification of the cottons of Asia and Africa will be welcomed by many of the agricultural scientists of India as well as of the world, as it is clear and concise and uses as its basis of classification the chromosomal structure and the genetical relationship of the different groups of cottons. The need for such a classification has long been felt in this country. This

work is a considerable improvement in the classification of the cottons by Sir George Watt, whose voluminous book has been for a long time the standard work on cotton in this country.

According to Hutchinson and Ghose, the cultivated Asiatic cottons fall into two main groups : (1) *Gossypium arboreum* and (2) *G. herbaceum*. These two groups, together with Harland's three groups of the cultivated cottons of the New World, *G. hirsutum*, *G. religiosum* and *G. barbadense* together make up the five groups of the cultivated cottons of the world.

The cultivated Asiatic cottons are further classified as follows : —

G. arboreum L. var. a. *typicum*.
var. b. *neglectum*.
var. c. *cernuum*.

G. herbaceum L. var. a. *typicum*.
var. b. *frutescens*.
var. c. *africanum*.

The first two varieties of *G. arboreum*, that is var. *typicum* and var. *neglectum* are further subdivided on geographical gronnds and on account of their recent evolutionary history into four forms which are called as follows :—

1. forma *bengalensis*.
2. forma *burmanica*.
3. forma *indica*.
4. forma *soudanensis*.

It is hoped that this classification will now be used throughout India by all workers in cotton so as to standardize the scientific naming of varieties.

Improved Methods of Cane Cultivation in the United Provinces (1936) R. L. SETHI, B. B. PRAMANIK, A. D. KHAN & R. B RAO. (*Superintendent, Printing and Stationery, Allahabad, U. P. 1937*, pp. 114.)

This bulletin on sugarcane from the workers in the Sugarcane Research Station at Shahjahanpur is a valuable contribution to the sugarcane agriculture in this country. The monograph will be found useful by all those who are interested in knowing the more recent developments in the agronomy of sugarcane in India.

The bulletin in the first place shows the very great importance of this province as the sugarcane growing area in India. The United Provinces has an acreage under sugarcane equal to about 50 per cent the total area under this crop in this country. And, out of the total of 156 sugarcane mills in the whole of India, the United Provinces can lay claim to about 71 mills.

As the results of extensive experiments carried on in the Shahjahanpur farm the authors seem to have come to the following conclusions :—

1. That in rich fields the highest yield is obtained by planting in trenches at a distance of 4 feet between the rows, the next highest on the flat followed by earthing when the distance between the rows is 3 feet apart, and the least on the flat without earthing. However they report that in poor fields, planting in the flat with three feet spacing followed by earthing showed better results than trenches 4 feet apart.
2. That February is about the best month in which cane-planting should be finished.
3. That ratooning, if practised, should not be carried beyond the first ratoons and that two ratoons may be taken only under highly fertile conditions,

4. That the sugarcane crop is invariably better whenever it is preceded by green manuring with '*sanai*' (*Crotalaria juncea*) than by any other crop.

5. That contrary to opinion generally held amongst cultivators flowering does not produce any effect on the sucrose content of canes, but that, on the other hand, it signifies that the cane is ripe.

6. That, in general, castor cake should be applied alone whenever it is cheap and easily available. But, if castor cake is not available, farm yard manure or compost should be applied supplemented with ammonium sulphate. The amount to be applied should be about 100 to 120 lbs. of nitrogen per acre.

7. That farm yard manure should be applied several months before planting and that it should be thoroughly mixed with the soil, but that castor cake may be applied one month to six weeks before planting. Ammonium sulphate however is to be applied just before sowing or after germination or at the time of tillering.

8. That potassic and phosphatic fertilizers have no effect on the yield of sugarcane.

9. That an application of about 280 maunds of molasses per acre has given good results but that an application of only 90 maunds to the acre is more economical.

10. That about six irrigations, applied throughout the growing period at the rate of 80,000 gallons per acre per irrigation, gave better results than 3, 4, 5 or 6 irrigations at the rate of 60,000 or 10,000 gallons.

The bulletin would have been more valuable if the authors had attempted to classify the sugarcanes grown in Northern India. A classification of sugarcane into thin canes, *paunda* or thick canes, and Coimbatore canes is very unsatisfactory. This work of classification requires a great deal of survey work and a great number of materials which only such a station as Shahjahanpur or Coimbatore can take up.

The Scrub Must Go —RALPH A. HAYNE.—(*International Harvester Co., Agricultural Extension Department, Chicago, Illinois, U. S. A.*)

This booklet of 31 pages contains some practical suggestions about the improvement of cattle, sheep and even chickens. The suggestions are simple and can therefore be easily understood even by laymen, who have not had any training in animal genetics.

The author describes a scrub animal as one that "has a long line of measly, mean, inferior ancestors, so many of them and all so mean that its life's work of worthlessness is cut out for it from the start, or it may have had so many different kinds of ducestors that it doesn't know what to do." In order to get rid of such animals the author made several suggestions, two of which are :

(1) Never use a scrub bull, whether he is a scrub individual or is of scrub breeding, and (2) keep only the best females.

The booklet is available from D. K. Parvate and Brothers, 627 Sadashiv Peth, Poona City.

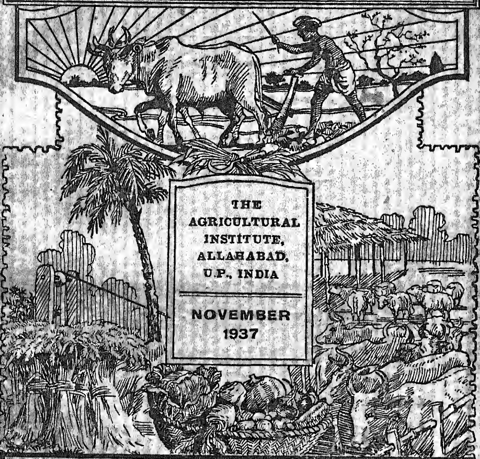
VOL. XI] [No. 6

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

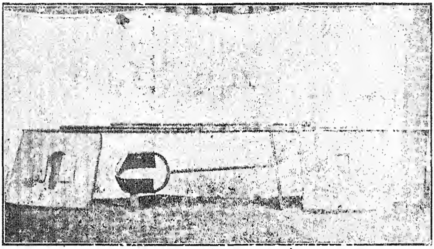
Agriculture and Rural Life



"So God created man in his own image, in the image of God created he him; male and female created he them.

"And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it."—GENESIS I: 27-28.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer,
Allahabad Agricultural Institute.

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by 3½ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the shear broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

MANAGING COMMITTEE

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Contributions

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Contributors will receive 15 reprints of the article published and additional copies at cost.

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The Allahabad Farmer

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Table of Contents

THE
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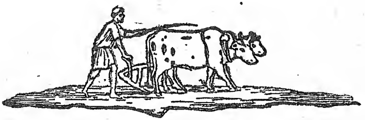

VOL. XI] NOVEMBER, 1937 [No. 6

Editorial

A Search for a Superior Germ Plasm

The discovery that inheritance follows definite laws is one of the greatest achievements of the human race during the last few decades. The significance of this discovery had for many years not been properly valued by laymen, and, to a very great extent, by biologists. But its importance in biological science is being slowly realised and is therefore being increasingly used in plant as well as in animal breeding. The working of these laws is being studied even in connection with man, and students of eugenics are beginning to advance theories based on the study of these laws as to how human society may be improved by controlled breeding.

At any rate the science of genetics is growing very rapidly and a proper understanding of the laws of inheritance has increased the efficiency of a plant and animal breeder considerably that it is questionable whether any one without a proper understanding of the elementary laws of genetics can now lay claim to be a plant or animal breeder. However, new problems have arisen in this field, as well as in other fields of science which await solution.

Scientific breeding of plants and animals is therefore gradually displacing the hit and miss method; and a scientific breeder can also accomplish a great deal in a shorter time than even an expert breeder, who, by dint of long experience and close observation, can sometime produce desirable results.

In order therefore that a combination of desirable characters may be obtained in any one individual plant or animal, it is necessary that a survey be made of the whole plant or animal kingdom. A search for the superior germ plasm of any one crop or type of animal is therefore very essential before any extensive programme of plant or animal breeding is undertaken.

The famous Russian group of plant breeders headed by Professor N. I. Vavilov sent several expeditions to different parts of the world in order to find the superior germ plasm of a large variety of crops that are being grown in their country. Thus an expedition was sent to South America to study the potato in its place of origin, another was sent to Arabia, Abyssinia and the central parts of Africa with a view perhaps to find the superior germ plasm in the *jowar* crop. Several expeditions went to other parts of the world to study wheat, barley, etc. Besides, crops from all parts of the world, especially from probable centres of origin where crop variability is the greatest, were sent for and grown in experimental breeding farms, in their country.

The other countries of the world such as the United States of America have also sent their emissaries far and wide in order to find superior plants for their country or at least plant materials containing this superior germ plasm which may be used for improving their crops.

There is in this country also a great diversity of crops. A proper survey of the crops available in the country is very desirable before any systematic system of breeding is adopted. But it is also of great importance that the scientific breeder understands what are usually

considered superior plants for any locality. For instance, whereas some regions require an early maturing crop others may require a late maturing one. A proper understanding of the problem to be solved is therefore the first essential before a search for a superior germ plasm is begun.

All this makes the work of the plant breeder very complicated and yet very fascinating. The tasks of producing crops that will be immune to all kinds of diseases and pests that attack them, crops that possess high yield and that may not be attacked by frost in Northern India, are all very interesting problems. These and many other related problems are a challenge to the best brains that this country can produce.

* * * *

Soil Classification

The problem of classifying the soils of India at present seems to be engaging the serious attention of the soil scientists of this country. But soil being such a complex factor we wonder how this work of classification would be carried on.

When chemistry first began to attempt to solve the problems connected with soil, it was believed that the chemical classification of soils would be the most practical and the one which would be of more benefit to the farmer. That is, it was believed that soils may be classified according to the preponderance or the presence of certain chemical elements in the soil. Such a classification however has been found not to be altogether satisfactory as soil is chemically a very complex substance, and very much dynamic in nature. That is, the changes which take place in the soil are continuous and often very rapid. The presence of certain chemical elements again does not always indicate the fertility or otherwise of the soil,

although it may indicate the potential productiveness of the soil, as most chemical elements may be so held in the soil that they may not be rapidly available to the plants.

The students of geology on the other hand seem to have laid more stress on the methods of classifying soils according to their geological origin or according to the geological processes involved in the evolution of the soils. But this method of classification also has its disadvantages and is therefore being replaced by other systems.

The method that is now more commonly adopted especially by the Russian soil scientists and also by those of the United States of America seem to be based largely on the study of the soil profile to a depth of about four to six feet. The American soil scientists, for instance, have been able to classify the soils of America into very broad groups, which are designated as soil provinces. These are further subdivided according to the nature of the profile into soil series. Finally the soils of the same series are classified into different soil types which represent the smallest unit of classification of a soil of any locality. Thus a 'soil type' includes areas of soil, having a uniform soil profile—uniform in all respects with regard to the number of horizons in the profile, their colour, texture, structure, thickness, chemical composition and the geology and character of the soil material. A 'soil series' includes all areas of soil having profiles that are uniform in all respects except that of the texture of the surface horizon. A 'soil province' includes an area over which a given soil profile prevails in the mature soil. This area however need not be continuous, but on the other hand it may consist of a number of detached areas.

Whatever may be the system adopted a proper survey and classification of the soils of India is very disirable. The experiences of other countries also should be used as a guide for our work of classification. This survey and classification, it is hoped, will give agricultural workers a fairly good basis for a proper understanding of the soils of this country.

Sir William Stampe

The retirement of Sir William Stampe, chief irrigation engineer of these provinces, from active service will, we understand, take place shortly. The news will be heard with regret by all those who are interested in the development of irrigation in these provinces, especially in the Allahabad district where a scheme for irrigating the southern portion of that area is now being mooted by him. A man with the push and energy of Sir William Stampe is hard to find. We therefore regret very much to know that his retirement is due so soon.

* * * *

Why is America Rich?

This is the title of an article by Arthur Huntington published somewhere in this issue. It is one of the several articles which have appeared from time to time in various magazines and journals from different writers. This article is orginally an adress to a society in America and was not meant to be exclusively an article for THE FARMER. We realized that there are various conflicting opinions on the subject, and we would therefore welcome articles either in support of or against the ideas put forth by Mr. Huntington.

* * * *

A New Dairy Expert for Allahabad

The Animal Husbandry and Dairy Department of the Allahabad Agricultural Institute is going to be greatly strengthened when a new dairy expert, James N. Warner, arrives from America early in November this year. Mr. Warner is a graduate of dairying from the University of Nebraska and an M.Sc. in dairy industry from the Iowa State College, one of the foremost agricultural colleges in the United States of America. Mr. Warner had also had some practical experience in commercial dairies in America. We believe that Mr. Warner will be a distinct asset to the institution to which he is coming, and that he will be a very valuable help to India at this time.

THE AGRICULTURAL SITUATION IN U. S. A.

MASON VAUGH

Agricultural Engineer, Allahabad Agricultural Institute

The present situation in American agriculture, while somewhat obscure and rather rapidly changing in some aspects, is interesting as indicating possible future trends in the development of Indian agriculture.

Just over 100 years ago, American agriculture was little different from the agriculture of India today. The plough used was of wood, crude and clumsy, and hand tools were often preferred as in India to it for preparing the soil for certain crops. Hand tools were largely used, areas cultivated per family or per person were small and 19 people were able to raise enough food for 20 to eat.

The cotton gin was developed about 1820, the reaper in 1832, iron ploughs came into general use in this decade and threshing machines came to be fairly common. The steel plough was developed in 1837 and was followed by hay-making machinery. Available unoccupied land made the utilisation of these machines fairly easy and they came rapidly into use. The Civil War drew large numbers of men from the fields and at the same time stimulated the demand for food to feed them, resulting in a tremendous further encouragement to the development of labour-saving machines.

Coincident with the development of agricultural machinery, industrial processes and machines were being developed, transportation by rail and water was being extended and the men from agriculture were rapidly absorbed into industry. At times the two processes of releasing men from agriculture and absorbing them into industry were not correlated completely and major depressions occurred, partly if not wholly because of this lack of correlation.

Late in the last century, the internal combustion engine became a practicable source of power and just at

the turn of the century the automobile appeared. By 1910 active efforts were being made to apply this new source of power to agriculture and the World War in 1914 to 1918 with its greatly increased demand for food production coupled with the withdrawal of men from farms and factories for the armies and for production of munitions greatly stimulated these efforts, resulting in the modern farm tractor which had reached a considerable degree of perfection by 1920. This new source of power had several effects. Coupled with new types of implements to go with it, the tractor made possible the economical production of wheat, and other crops to a less extent, on land which with animal power could not be cultivated profitably. In the areas where animal power was being used, the substitution of tractors released the acres formerly devoted to growing food for work animals. Much of this land also was diverted to growing cash crops of grain for sale.

Coincident with the latter part of this development, following the war, nations which had formerly imported large quantities of grain and animal products began to make heroic efforts to be self-sustaining in food crops. American tariff policy pointed the way for other countries by shutting out the manufactures with which they had formerly paid for food as during the war America had developed her own factories for making these things, for the most part. Other countries followed suit, imposing prohibitive tariffs and even quota embargos. This shutting off of foreign outlets plus the greatly increased production resulted in a large and increasing surplus of agricultural products. This depressed the price which could be secured for the part of the crop which could be marketed to unprecedented low levels. Attempts to remedy this condition with tariffs, coupled with attempts to restrict production, lost a large part of the foreign market for cotton to other countries where cotton growing was rapidly developed, and to a less extent the same thing happened with other crops.

During the era of high prices during and just following the war, farmers bought land at high prices, usually on mortgages on which high interest was paid. When the prices dropped and crops became almost unsalable, these mortgages became unbearable burdens and mortgagees, largely insurance companies and other security-holding companies, had to take over the land in satisfaction of the mortgages.

From about 1930 on, various attempts have been made through government action to restore the farmer to the relative position he had held before relative to industry in earnings and markets. These first took the form of loans on impounded products withheld from the market in the hope of rising prices; later, production control was combined with subsidies for non-production to be paid from processing taxes on agricultural products. This was declared unconstitutional and stopped in a short time. An effort is now being made to secure somewhat the same results through a programme of "soil conservation".

As was to be expected, when a tremendous new country was opened up and put under cultivation by people from old lands where natural forces had been stabilised as the result of centuries of similar conditions, inadequate attention was paid to the soil erosion resulting when land was taken from forest or grass and put into crops requiring annual ploughing, if not interculture. As long as land was plentiful, any areas seriously damaged by erosion could be abandoned and others substituted. The stage has now been reached where there is little or no land really suitable for cultivation which has not been more or less occupied. While the problem of erosion, both by water and by wind is no new problem, (the Mississippi valley, as the Ganges valley, is a fill made by the results of erosion in the past and there are areas in the Mid-West where wind-carried deposits are two hundred or more feet thick) and while agitation for more attention to its prevention has been carried on for 25 years or more by agricultural engineers,

it is only in the last few years that the problem has seriously caught the attention of the public or of governmental agencies.

When the Agricultural Adjustment Administration was declared illegal, a rather comprehensive programme was worked out based ostensibly on soil conservation and improvement. Instead of leaving land idle, farmers were to be paid a subsidy for putting into effect a comprehensive programme of terracing, building of soil saving dams and the growing of cover crops and of crops which were not considered responsible for "unmarketable surpluses". A farmer was not eligible for "benefits" unless he adopted the whole programme for a period of years and put himself more or less completely under the direction of Agricultural Department officials. This conservation programme, designed to reduce erosion, has been coupled more or less with a programme of loans to refinance mortgages and the buying up of so-called "sub-marginal land" for reforestation.

Simple as it may sound in this statement, this programme has not been without complications. Mechanical methods of erosion control, such as terracing are fairly well understood and while much progress has been made in methods of carrying out the work, the principles have not been much changed. The equipment has been greatly improved. The greatest problems have arisen over the crop substitution part of the programme. If grass is to be substituted, this means a lower income and an increase in animal production with consequent possible disastrous lowering of prices. Something can be done in substituting crops now imported but that disturbs export markets. There has been some development along the lines of new crops as for instance the soy bean which has increased to some 7 or 8 times the former production in a few years and much of the increased production has gone into more or less new uses, though there is inevitably some displacement, some substitution for other products.

There is a great deal of discussion as to just what is a surplus—as to whether the amount sold is a function of the price. Undoubtedly in some cases a reduction in cost will mean an increase in consumption but this is not true of all products. Advertising has increased the consumption of some things very greatly but in many if not most things, there is a corresponding reduction elsewhere. A rising standard of living seems to result not so much in an increase in quantity consumed but in a change in the selection and an increase in the variety of products, so far as food is concerned.

What are the trends? In what direction is development likely to take place? The last few years have seen a very considerable increase in the amount of governmental regulation of agricultural production. Many argue for an increase in this; others are strongly favouring a decrease. Subsidies are insidious and once started are difficult to discontinue. It seems likely that there will be a continuance for some years at least of a considerable degree of governmental control. The extent will depend somewhat on the political party in power and on other factors, but I judge the tendency is for a continuance for some years.

Agricultural practice is changing to meet changed conditions. The trend away from animal power towards mechancial power and towards increased power controlled per man continues though the curve is not constant. During the worst years of the depression, there was some tendency to return to the use of horses but the numbers in use continued to decline, the change being in the rate of decline. As soon as conditions began to improve, the rate of increase in the use of tractors again increased and the demand for horses has declined materially.

The availability of public relief has further increased the previous difficulty of securing agricultural labour for transient employment and in some cases for permanent employment. The tren l very definitely is in the direction of again organising and equipping farms on

the basis of the family doing all its own work without hired help or with the aid of help hired permanently the year round. This has meant developing machinery to care for the peak loads which had previously meant hiring transient labour. The combine is an example of this trend, especially in the recent development of smaller sized but highly efficient machines for harvesting a very wide range of crops and which are worked completely by a tractor which pulls it.

The tractor and its associated implements was originally a large scale farming equipment. There has been great activity recently in developing smaller size tractors and complete lines of cultivators and planting equipment to go with it to enable the farmer having only a comparatively small area to work it with an efficiency approaching that of the large operator. The tendency towards large scale corporation farms seems to have halted. There is some tendency for groups of farms to be operated under the direction or advice of an expert, often if not usually a trained agricultural engineers, but operated by individual operators, either owners or tenants.

The trend is very definitely in the direction of increasing the proportion of the total capital invested in equipments and improvements such as buildings and a decrease in the proportion invested in land. While there is a definite increase in tenancy in recent years, it is not all because of men being forced out of ownership by mortgage foreclosure. There is a considerable and probably increasing number who prefer to remain tenants because they consider that their money invested in equipment and as working capital brings them greater returns than if invested in land—in other words, it is cheaper to rent than to own, in terms of their total net income from the capital at present invested. In other words, the farm is increasingly being recognised as a factory where certain vegetable and animal products are manufactured and that here as elsewhere, the efficiency of the factory depends primarily on the equipment used in the process

(*Continued on page 308*)

WHY IS AMERICA RICH?

By Arthur Huntington

Why is America rich?

Why are we the most prosperous nation on earth?

Simply because by the use of power and equipment we have increased the output per worker until we are the greatest producers of all of the nations.

We out-produce our nearest competitor :

England	by	46%
Canada	"	59%
Belgium	"	84%
Germany	"	133%
Czecho Slovakia	"	204%
Austria	"	250%
France	"	260%
Holland	"	366%
Poland	"	733%
Italy	"	1030%
Japan	"	1490%
Russia, India, China	"	more than 2000%

In order that there may be no mistake let us for a moment consider some of those things which are commonly supposed to render so much service and are basic in the development of the American people. Perhaps other nations may have failed to prosper as we have, even though they may have a greater measure of those things which we seek.

Is our prosperity our soil? If so China, India, Egypt, Belgium and many nations would far surpass us, for each of them have long made two blades of grass grow where we have made only one to grow.

It can hardly be our climate for even in our own country where the climate is the poorest the prosperity and wealth is the greatest.

It can hardly be our superior intelligence. The scientist of Germany and the men of letters of England and the men of art from Latin Europe rank well up with our best. We are just beginning to learn of things which have been the common heritage of the Orient for untold generations.

Is it our cheap labour ? Our men of industry think and talk in terms of cheap labour, yet those nations which have cheap labour are far down the scale. Even in America those industries which pay a low wage are the least prosperous. No! Prosperity and wealth are both measured in terms of high wages and high living standard.

It can hardly be Unionism, or Corporation or Co-operation.

American labour is less than half as well organized as England and the caste system of India is Union Labour gone to seed. If it were Unionism, India should be more prosperous than England and England more prosperous than America.

Corporations and Trusts do not create monopolies or profits. In America monopoly exists, not on account of organization or high prices, but by producing a product so cheap that none can compete.

No cooperative agency can compete with America's mass production, low cost methods. Prosperity does not come with a high price. Our greatest fortunes have been made on a multiplicity of small profits.

It can hardly be tariff. Many nations boast of tariff walls which are higher than our own, yet our manufacturers and farmers are able to go over these artificial barriers at will. Spain with the highest wall of all and England with her Free Trade fail to compete.

At home those industries which have depended most on the tariff protection, generally speaking, have the

lowest wages and are the least prosperous, whereas those which have gone into the markets of the world, neither asking protection at home nor recognizing tariff walls abroad, have the highest standard of prosperity and pay the highest labour wage.

It is neither water power nor water transportation. The great water powers of the world are undeveloped and many which are developed are unable to compete with our modern steam plants and the great natural waterways of the world have failed to compete with even ordinary land transportation. Our own Mississippi could not compete with the immature rail sysetm of a generation ago. The canals and waterways of Europe must receive government protection to survive. The Grand Canal of China has fallen into decay because it has been unable to compete with the wheel-barrow. We are beginning to learn that tonnage handled through efficient terminals and low overhead charges and not the actual haul are the dominant factors in transportation.

It is not permanent construction. Egypt ranks first in the permanency of its construction and is followed by China, India and the older cities of Europe. Our most prosperous cities are those in which the useful life of a structure is the shortest and the most prosperous industries are those in which the equipment becomes obsolete the soonest.

While each is a factor our prosperity is not our soil or our climate or the utilization of our natural resources or tariff, or intellect, or the permanency of our institutions or our ability to make two blades of grass grow where only one grew before that gives us our pre-eminence.

Our wealth is a production wealth. Our motto has been, to make one man produce that which took two men to produce before and to make one dollar do the work of many dollars ; to never exhaust our man power performing those tasks which can be entrusted to a machine.

It has not been built up out of excessive profits but out of small profits and at a cost so low that none can compete. Each workman has become the director of a machine which produces an output equal to the production of many men for which he has received the highest wage per day known to history and the lower wage per unit of output than any of the cheap labour nations.

Nations are civilized in proportion to their ability to release workers from the arduous task of producing food, clothing and shelter and to efficiently employ them in producing those things which are associated with higher standards of living. They are roughly prosperous in proportion to their ability to multiply the producing ability of the workers with the use of power and equipment.

By such means America has been able to multiply the producing ability of the workers 35 fold as compared to the producing ability of those workers not so equipmented. Our closest competitor is Great Britain which only increased the production per worker by 24 fold. The wealth, the wages paid to labour and the living standards of the two nations are roughly in the proportion of 35 to 24.

Let us compare the ability of the nations of the world setting opposite each its ability to increase the production per worker by the use of equipment efficiently used.

America	..	35	fold
Great Britain	..	24	,,
Canada	..	22	,,
Belgium	..	19	,,
Germany	..	15	,,
Czecho Slovakia	..	11.5	,,
Austria	..	10	,,
France	..	9.7	,,
Holland	..	7.5	,,
Poland	..	4.2	,,

Italy	.. 3.1	fold
Japan	.. 2.2	"
Russia	.. 1.6	"
India	.. 1.4	"
China	.. 1.2	"

Man gets paid for what he produces and America's wealth is the reward of the producing ability of her workers. Her living standards and her rapid advancement in the councils of the world are the reward of a just and liberal use of this machinery and power made, mass production wealth.

THE AGRICULTURAL SITUATION IN U. S A.

(Continued from page 303)

of manufacture. Land is only one item of equipment and its relative place of importance is decreasing, in terms of capital invested.

To sum up: (1) The last two or three decades have been the culmination of over a century of reorganisation of agricultural practice. (2) The change has been greatly accelerated recently, resulting in a very severe depression. (It is recognised of course that there were other factors involved in causing the depression.) (3) Recent trends are a greatly increased governmental control of agriculture; a continued tendency to replace animal with mechanical power; a decrease in the supply of transient labour; the development of equipment to care for the peak labour loads of the farm without hiring casual labour; a halting if not reversal of the trend toward corporation farms; and an increased appreciation of the value of equipment in the farming process with the result that an increasing proportion of total capital invested is going into equipment, building, etc. and a decreasing proportion into land.

POULTRY KEEPING IN INDIA

By W. R. Chester

Student, Allahabad Agricultural Institute

As India has been for ages the original habitat of the different varieties of jungle fowl, what is more probable than to picture the people living in village in bygone ages near the haunts of the jungle fowl as being some of the first of mankind to domesticate the wild fowl and use it for their own benefit.

The foundation of all real progress and improvement in breeding fowls emanated from the sport of cock-fighting, and it is to this sport that we owe so much, wherever fowls have spread.

An interesting record on "cocking" written in 1883 by a Nawab of Rampur, shows how keen was the interest taken in cock-fighting in those days.

The majority of the people of India take no interest in fowls. The Hindus, except those of the very lowest castes, look on them as unclean, and are not permitted by religious rules to keep them. The Mohammedans, Sikhs, Christians and many others, however, have no such scruples and as they form a very considerable portion of the population, they should be encouraged to keep poultry in a clean and proper manner.

The keeping of handsome fowls appeals to the Indian of culture as he is always an admirer of the artistic and beauty.

The possibilities of poultry farming on a large scale in India are at the present time limited. There are not many commercial egg farms, such as are seen in the West, for the supply of eggs, but there is no reason against their ultimate establishment, especially near large cities. A very lucrative business is carried on by breeders of pure bred fowls who find ready purchasers for settings of eggs and chicks. In most parts of India the climate during the early part of the year is admirable for

rearing chickens. The personal character of the attendant is a very important factor in poultry work, as no lazy, careless person can ever succeed in this industry.

The question of climate is not so great an obstacle as might be supposed. Fowls are most adaptable creatures and will soon accustom themselves to any environment provided they are not unreasonably exposed to the tropical sun, hot winds, monsoon or winter rains.

There is no business or industry that can be started on such limited capital as poultry farming, but any one starting a poultry farm should possess enough money to carry him over the first year. Until one gets to understand one's fowls, how to treat and feed them properly, one cannot expect to make a profit. It is much wiser to begin in a way with just a pen or two of first class stock, working at these while you are still carrying on your profession or business, and then when you wish to retire and still add to your income, you will have had the necessary experience to launch out into a large farm.

Half the battle is to start with good stock and the other half is to have the ability to manage it well. Buying cheap bargains in poultry is a mistake, quality is far more necessary than quantity. An inferior pen takes up as much room and cost as much to feed as one of the first class quality, and in most instances the inferior hen does not lay a sufficient number of eggs to pay for her keep, whereas a first class one should give you a considerable return per year over her feed and keep if managed on a commercial basis.

Remember that the strain, or family, from which your bird has been bred is of more importance than the breed.

The conditions of poultry keeping in the East are very different to those prevailing in other countries, therefore the beginner, to be successful, must become acquainted with local peculiarities. In the warm and genial climate of the East, elaborate fowl-houses are necessary, neither do the fowls require such heat producing food.

Birds kept in confined though roomy runs appear to do the best out here, and a loose sandy soil is the most suitable for them. This is reckoned as poor land from an agricultural point of view, and is therefore cheap to purchase, but it makes ideal runs for fowls, and after some time this poor land, after being impregnated with poultry manure, will prove extraordinarily fertile for market gardening, fruit growing, etc. If the value of poultry manure were more appreciated, zamindars and landowners would be more anxious to adopt poultry farming in order to improve their so-called waste land.

For the farmer who works along business lines poultry should figure prominently amongst the most profitable members of his livestock. During harvest time there is plenty of loose and damaged grain to be collected for the animals. At threshing time, too, much grain which is often wasted can be recovered for the birds. If the farmer makes butter he will find himself with much valuable food by way of skim milk.

Even to the owners of suitable gardens poultry keeping should appeal. Few animals give a quicker return for food consumed than poultry. In gardens attached to country residences there is always plenty of surplus and waste vegetables that come in useful for the poultry, and in normal times the scraps from the kitchen are on the heavy side. These can be turned to the best account where poultry is kept.

In all national pursuits the Government should do its utmost to help those concerned. Especially should this be so where the production of the nation's food is at stake and where the producers are endeavouring to blot out imports from foreign countries and retain the rupees, annas and pies for the people of their country. It is not, therefore, too much to ask the Board of Agriculture to take these home industries under its wings in the only way that is practical. In other countries small producers seem a power, and if such is the reason of their success the road must be made easier for our own small holders, small farmers and even cottagers.

POTATO AND ITS CULTIVATION

By T. S. Rathore

The potato originated in South America. One group of potatoes probably originated in Chile while other varieties have their independent origin in the Peruvian plateau. The first known reference in literature about potato is found in Cieca's "Chronicles of Peru" published in 1553 which states that it was a common source of food in Peru.

According to Carrier (1923), potato was probably brought to England about 1586 by Sir Francis Drake who obtained it from the West Indies.

It then slowly spread into all European countries and has now become so important that it is perhaps the most popular among the root crops and is taken practically every day along with other articles of food.

It is not certain as to when it came to India, but its use as food has become prevalent among all classes of people.

The potato plant belongs to the genus *Solanum*, which includes over 700 fairly distinct species. But those of specific rank possessing tubers are only six in number, the common potato (*S. tuberosum*) being one of them.

The stems above ground are angled, generally erect, with winged margins and the leaves compound-pinnate. The flowers are produced in terminal cymose inflorescences. The fruit is a globose smooth berry.

The tuber is composed of four parts, namely the skin, the cortical layer, and the outer and inner medullary areas. The inner medullary is called the "Core" It is watery and spreads irregularly from the centre. The skin makes up 2. 5 per cent of the tuber, the cortical layer 8. 5 per cent, and the outer and inner medullary areas 89 per cent.

The potato contains 78. 3 per cent water, 2. 2 per cent protein, 18. 4 per cent carbohydrate, mostly starch; 1 per cent ash and 1 per cent fat.

The composition of different parts of the potato is given as follows:

		Starch	Nitrogenous matter	Water
Cortical layer and skin	..	19.42 %	1.99 %	74 79 %
External medullary area	..	16.29 ,,	2.14 ,,	77.44 ,,
Internal medullary area	..	11.70 ,,	2.70 ,,	82.16 ,,

The starch decreases towards the centre while the nitrogenous matter and water increases.

The quality of potatoes is based on the character of the flesh when cooked and is of three kinds: mealy, soggy and waxy. The mealy ones have a high percentage of starch and such potatoes are preferred in America. The soggy ones have a high percentage of water and a low percentage of starch. When cooked the material remains heavy and moist. These potatoes are preferred in European countries. The waxy ones are half way between the above two qualities. Wariness is a character also found in new potatoes which also possess a high percentage of protein relative to staroh.

The potato is used to a great extent as food, especially in some European oountries. The chief article manufactured from it is starch which is used for laundry purposes, for sizing paper and textile and various other purposes.

* * * *

Potato is a cool weather crop; both quality and quantity being adversely affected by high temperatures.

The potato plant is most sensitive to both drought and excessive moisture. The great hazard is drought. The condition is well fulfilled by evenly distributed showers. An abundant supply of moisture is very important at the time of tuber formation and practically a thoroughly dried soil at the time of harvest.

Potatoes require a rich soil. The plant food materials in the soil should be readily available. Since the control of moisture present in the soil is most important in the production of potatoes, hence the physical condition

should be such as to keep the optimum moisture in all cases.

"A deep sandy loam rich in organic matter with good natural drainage is an ideal potato soil."

In order to develop and maintain satisfactory soil conditions for potatoes, legumes should be grown. Manure and crop residue should be returned to the land and a suitable crop rotation should be planned.

Newly cleared forests are especially desirable for potatoes. It is of great importance that the soil be not only fertile, but in a good mechanical condition: loose, friable, deep and mellow. The crop does specially well after a good green manuring crop. The soil should be ploughed deep as the tubers are generally formed within 6 inches of the surface.

Except on rich garden soils or soils abundantly supplied with humus, the best fertilizer for potatoes is well-rotted barnyard manure. When applied directly to the potato crop, the tubers are likely to be scabby. It is therefore usually applied to the previous crop, but in such abundance as to leave the land well-prepared for potatoes.

In the culture of potatoes the soil should be ploughed deep, and the seed bed should be kept loose. Ploughing should be done preferably to a depth of 8 inches. The land may be cultivated any number of time according to needs. Each cultivation is followed by harrowings and cross-harrowing to break down clods and tear up weeds and then weeds are finally collected with a chain harrow or by hand labour and burnt or removed from the field.

After the land is well ploughed and harrowed, it should be set up into ridges, usually with a double mould-board plough. The field should be as long as possible and the ridges should be at right angle to the main irrigation channel. The ridges made with a ridging plough may not be absolutely straight but must be fairly so. The distance between two ridges must be about twenty-four inches.

The number of varieties of potatoes commonly grown in this country are numerous, but some of the well-known ones are Phulwa, Kabara, Patna, Pahari, Darjeeling, Madras, Shillong, etc.

Potatoes deterorlate in the plains very rapidly and hence as far as possible the seed must be changed every now and then.

A good potato must have one or other of the following qualities: (1) earliness, (2) good flavour, (3) high yield, (4) disease resistance and (5) handsome shape and clear skin.

* * * *

The best time for planting potatoes varies with the locality and also with the earliness or lateness of the variety. The sowing in this province should be done after all fear of late rain is over, say about the 20th to the 31st October or even later.

In general, the potatoes should be planted 2 to 3 inches deep. Where the soil is warm, light and well-drained, deep planting provides more favourable moisture and temperature conditions.

The average rate of planting is from 8 to 10 maunds. The size and the distance of planting determine the quantity required. By increasing the rate of planting, the yield is increased but the yield per hill and the size of the tubers are reduced. The rows should be 2 feet apart, with the hills 10 or 12 inches apart in the row.

Whether all the plants come out within a fortnight or not the first watering should be given within 10 to 15 days after planting. The tardy sprouts will come up after the watering. If seed potatoes are kept indoors under a heap of moist straw or over damp sand for a week or so before planting the sprouting will be quicker and more even after planting. Hoeing should be done within a week after watering. The first earthing up should be done when the plants are six to nine inches high. Then two waterings at the interval of a fortnight and then the

second earthing. If the soil looks dry, another irrigation should be given after or before the two earthings at once in ten days. Three to six irrigations are necessary according to locality. But in some places potatoes are grown even without irrigation, which is exceptional.

Cultivation is one of the important factors in the production of potatoes, and the time of cultivation is as important as the number of cultivation. The soil should be stirred as soon as possible after each irrigation. Potatoes should ordinarily be cultivated once every ten days during the early growing period. It is a good plan to ridge after the tubers begin to form in order to prevent exposure to the sun, as this may cause a second growth.

The first cultivation should be deep and close to the hills in order to loosen the soil which has been packed by various means. A light harrow or weeder should be run over the field. This will kill the weeds that are just starting. Harrow the field again about 10 days later and again when 3 to 4 inches high. This harrowing, especially if the teeth are slanting backward, will not harm the young potato plants, but will keep the weeds down. Thereafter cultivation between rows should be shallow and frequent throughout the growing period.

The early crop of potatoes may be dug and harvested just as soon as the tubers have reached marketable size. With the main crop, however, the potatoes should be left undisturbed until the vines are dead and the tubers well ripened. If the tubers are immature, the skin is tender and easily rubbed off in handling. The crop may be dug by hand with a 4-tined fork or a potato hook, but in large fields the expense will be lessened by using some of the many potato diggers now found on the market.

Because of the prevailing high prices of potatoes early in the season, harvesting of early varieties usually begins before the crop is mature. The attractiveness of the price determines very largely the time of digging. If the price is high, harvesting should begin earlier and continue more rapidly than if the price is low. As a rule,

the loss in yield by early harvesting is compensated by the higher prices. Immature tubers are perishable and are marketed direct from the field. Potatoes to be stored for home use are harvested when matured.

In the plains of northern India potatoes are generally harvested in February and March, but rarely in January. In January, only the early sown crops are harvested.

The yield of 100 maunds to 150 maunds per acre is a fair outturn, though as much as 300 maunds per acre is sometimes obtained.

Potatoes are kept over winter either in a cool dark cellar or in pits made in the field. In the field a good size for pits is 4 feet wide, 4 feet deep and about 6 feet long. The pit should be filled heaping up and 6 inches layer of straw or hay spread over the pile and a little earth. The pile may be left thus for the potatoes to sweat and cool off until the approach of cold weather, when it should be covered about 18 inches deep with earth and 2 feet deep with barnyard manure or straw. Potatoes are greatly injured by freezing, being made unpalatable and unmarketable. For a proper storing of potatoes the temperature of a storage room should be about 40° to 45°F. at the beginning of the storage period, and then gradually lowered to 34° to 36°F as the season progresses. Due to poor ventilation, the temperature rises and potato acquires sweatish taste due to the formation of sugar which is undesirable. Places which are too hot and damp are very bad for storing potatoes. Humidity may be controlled and can be reduced by scattering $CaCl_2$ or lime over the floor and may be increased by sprinkling water on the floor. Ventilation and light for the storage room are also important and must be well taken care of. Lack of ventilation causes decay while an abundance of light causes greening of potatoes.

Due to the above reasons, potatoes stored in the hill stations are much better than those stored in the plains. Seed potatoes from hill stations when sown in the plains show a better outturn than those stored in the plains.

Potato diseases are very grave hazards to potato production. Potato diseases may be classified into three main divisions. (*i*) those due to organisms that live from year to year in the soil, (*ii*) those orgainsms that live in storage room, and (*iii*) those caused by air-borne spores.

The first type of organisms are difficult to control. They may live in the soil for several years and may not be destroyed at all. But the seeds may be treated by formalin or mercuric chloride (corrosive sublimate) and organic mercury compounds. The formalin treatment is one pound (pint) of formalin to [illegible]0 gallons of water. Mercuric chloride is a violent poison and care should be taken to handle it, potatoes not used for seeds should be buried or burnt. Its proportion is 4 ounces of it to 30 gallons of water. Organic mercury compounds are new as yet. Their treatment is one pound of compound to 2½ gallons of water. They are also poisonous and care should be taken in using them. Diseases caused by airborne organisms are very well controlled by spraying bordeaux mixture. 50 gallons of spray per acre is sufficient.

The most common diseases found on potato are (1) late blight, (2) early blight, (3) common scab, (4) rhizoctonia, (5) blackleg, and (6) Fusarium wilt.

Amongst the numerous insects that attack potatoes the following may be mentioned:—

(1) Potato Aphis (*Macrosephum solanifolii*). They are what we call plant lice and the best way to control them is to spray nicotine sulphate or free (4%) nicotine and soap solution The rate is 2 lb. of soap to 50 gallons of water.

(2) Blister bettles:—(Moloidæ). They are bluish black in colour and of other colours also. Bordeaux mixture works splendidly but if it is not available, use barium or sodium fluosilicate at the rate of 2 lb. to 50 gallons of water.

PREPARATION OF PEANUT-MILK*

1. Preparation of peanut meal.—Shell the peanuts and dry them in the sun for several days. If you desire the milk for young babies, remove the skin by pouring boiling water over the shelled peanuts and then allowing them to stand till the water cools, and the skin may easily be removed by hand.

After the skins have been removed, put the peanuts in the sun for several days.

If the baby is three months old, leave the skins on the peanuts, grind in a food grinder or pound them in a mortar. Then put them in an oil-press and press out as much of the oil as possible. Various methods may be tried for removing the oil.

After the oil has been removed the resultant product is peanut-cake. When dried put the peanut cake into a mortar and pound to a fine meal, then sift it until it is very light. For this purpose we use the winnower which the native women use for separating the chaff from the grain.

2. Preparation of peanut-milk.

INGREDIENTS :

Peanut meal—grams 70.

Banana mashed—grams 10.

Egg—one.

Water—one quart.

(Calcium carbonate) or Lime Water.

Add the boiling water little by little to the peanut meal, rubbing well after each addition so as to make a fine paste. Let it come to the boiling point for five minutes longer. Remove the boiler of the milk from the

* From the materials supplied to us by Agricultural Missions Foundation, Inc. New York, N. Y.

stove and pour back and forth from one container to another until it is cool. That process gives it a natural milk appearance. Add the calcium and the egg that has been well beaten. Mash the banana until it is a smooth paste and add to the milk. Treat the milk as if it were cow's milk and make the desired formula.

For babies under three months of age, syrup or brown sugar is used in place of banana. Honey and cane sugar have been tried but it is difficult to keep.

[The above recipe was prepared by Miss Esther Bjork, nurse, W.F.M.S., Kambini, Inhambani, Portuguese East Africa.]

Another recipe for peanut-milk is as follows :—

3. Preparation of peanut-milk—Used in Africa for infant feeding.

TO MAKE ABOUT ONE QUART :

Peanut meal—grams 70.

Calcium carbonate—grams 10.

Water (Sterile)—1,000 c.c. (one litre).

Banana.

Method :—Rub the peanut meal in a large mortar with a pestle until it has been reduced to a fine soft powder. Add the water little by little, rubbing well after each addition so as to have a smooth paste. To this paste add the calcium carbonate and triturate thoroughly in suspension. Allow the mixture to stand for a short time until there is a sediment and then pour off the upper fluid. Again triturate the sediment until smooth and then gradually add the fluid which has been poured off, triturating thoroughly as before. Repeat this process until the mixture is smooth. The result should be a smooth milk-like emulsion.

AN OLD BOYS' ASSOCIATION OF THE ALLAHABAD AGRICULTURAL INSTITUTE

Last year at the Old Boys' Day the question of an Old Boys' Association was thrashed out by the old boys who were present and it was resolved that a local committee of the old boys should be formed to frame a circular letter and invite the opinion of all the old boys about starting this association. The letter was framed, printed and published in the ALLAHABAD FARMER, Volume XI, No. 1, January 1937. Nearly three hundred copies of this letter were sent out during the current year, and the abstract of certain letters which we received and which contain definite suggestions, are given below. I am sure there are many other who have valuable suggestions to make but somehow did not get an opportunity to make suggestion. I request our old boys who are subscribers of the ALLAHABAD FARMER, through the esteemed pages of this magazine of our *Alma Mater*, to come forward with their suggestions. Let us create a medium by which we can renew our connection of brotherhood, and through it help those unfortunate brothers who have not been able to secure jobs and rejoice over the fortune of those who are holding good positions.

I would suggest the following for the effective organization of our Old Boys' Association. Let the Principal be made president and one from among the old boys vice-president. Let two joint secretaries be elected one to be from the old boys, preferably from among those living in or near Allahabad, and one from among the present staff and students. Personally I would like to see all the office bearers elected from among the old boys, but this may not work effectively. If the majority on the executive body be from those who are very closely and directly connected with the Institute or from those living in and near Allahabad, the organization may work effectively.

This plan may be tried only for some years until our old boys are able to run the organization themselves. All old boys are requested to become members. The membership fee is Rs. 2 per year.

A. Dayal Chand, M.A., B. Sc. Ag.,
F. R. H. S. (London), *Secretary*.

Mr. T. Ahmed, I. D. D., Manager, Government Cattle Farm, Kanapara, Gauhati, writes:—" I quite agree with you and appreciate your idea about the organization of the Old Boys' Association and the old boys may gather once in three years if not annually. Probably any time between May and October would be suitable for this gathering. Oh! how glad I would be amidst old friends to exchange our thoughts and ideas. Certainly it would give me a great pleasure to be present there if such an organization is established".

Mr. D. H. Anjaria, Inspector, Poultry Farm, Government of Bombay, Poona, writes:—" I fully support the idea and am ready to be its member and pay the necessary donation. I feel strongly that all Dairy Diploma holders should become members of this association. I have full faith in the present committee of the local old boys and request them to draw up laws and bye-laws with the guidance of our experienced Principal, Dr. Sam Higginbottom, and other members of the staff. I agree that we all should meet once to pass the constitution of the association."

Mr. K. Raja Rathnam, teacher in Boys' High School, Nellore, South India, writes:—" I fully concur with your views that the old boys of our college which is growing and turning out great work should be closely knit to their *Alma Mater*. I am sure that all the other old boys share the same view. I thank from the bottom of my heart, all the organizers of the Institute Student Union for the step they have taken in celebrating the Old Boys Day."

Reviews

The Foods of a Hindu Village of North India. CHARLOTTE VIALL WISER. *Superintendent, Printing and Stationery, United Provinces, Allahabad.* 1937. pp. 121. Price Rs. 2-8-0.

This book is the result of a careful study by a student of village life in Northern India. The author for the purposes of this study, seems to have taken great pains to acquaint herself with the food materials which are used in an ordinary village home. This, together with references to the work on nutrition done not only in this country but also in other countries as well, makes the book a very valuable contribution in the field of economic studies of village life in India. The suggestions and recommendations made towards the end of the book with regard to the diet for an Indian home in Northern India if followed will, we hope, improve the health and material well-being of the village people. The book therefore, should be of great value to all those who are working amongst the village people in India.—(EDITOR)

The Nature and Properties of Soils. T. LYTTLETON LYON & HARRY O. BUCKMAN. *The Macmillan Company, New York.* Third Edition, 1937. pp. 392.

This is a new edition of a very popular text book in Soil Science. The book has been brought more or less up-to-date and should therefore be substituted for an earlier edition of the book entitled "Soils, Their Properties and Management" published in 1927 and written by three authors: Lyon, Fippin and Buckman. The authors of the new edition have reorganized the material and have placed certain emphasis on some phases of soil studies such as the study of the soil profiles, the colloidal nature of the soil and the organic matter in the soil. This

edition also contains several references to soil mulches and as to whether they are beneficial for conserving soil moisture or to what extent they may help in the prevention of the rise of alkali to the surface soil.

The book will also be found useful by practical agriculturists as it contains suggestions about the maintenance of soil fertility, the use of farm-manure and commercial fertilizers, the utiliz ition of green plant manures, the application of lime for the correction of soil acidity and other undesirable conditions in the soil, the control of soil moisture, etc.—(Editor).

Soil Conditions and Plant Growth. E. John Russell. *Longmans, Green & Co., London.* 1937 Edition. pp. 655

This is the seventh edition of a book from the pen of Sir John Russell who was here in India last year to review the work of the agricultural departments in this country.

The book is a very useful reference book on certain phases of the subject matter covered in the soil book reviewed above. This book treats such subjects as the soil con ditions affecting plant growth more elaborately than could be treated in an ordinary text book on soils. The changes in the organic matter of the soil, its mineral composition and the micro-organisms in the soil are also dealt with fully in this book.

The book is therefore to be recommended to students of agriculture who wish to make a special study of soils in their relation to plant growth.—(Editor).